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Survey of beginning data processing personnel employed in the Edmonton, Alberta area

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A SURVEY OF BEGINNING DATA PROCESSING PERSONNEL EMPLOYED IN THE EDMONTON, ALBERTA, AREA

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INTRODUCTION

The tremendous progress which has occurred in business, education, government, medicine, and science during the past century appears insignificant compared to the changes currently occurring in these fields as a result of their adoption of electronic data processing techniques during the past decade. The prospects for further applications of computers and the implications of their use are destined to have an unprecedented impact on education.

Perhaps in no field has the impact of automation been felt so greatly as in office practice. Office automation is a reality; it is a fact of life. By 1963, more than 12,000 electronic computers were in use in the United States. This has happened in a short decade--the first computer was installed in 1953.

Electronic data processing has influenced the curriculum in business education as it has helped to create many new jobs which did not exist merely 15 or 20 years ago. These new jobs require new knowledge, skills, and understandings which would help prospective employees obtain, and succeed in, their new positions. Society generally looks to the schools to provide for new educational needs and qualifications. Very little research is available to aid in the undertaking of meaningful curriculum changes and the evaluation of present programs in data processing.

I. STATEMENT OF THE PROBLEM

The present study is undertaken to determine the major employers of beginning data processing personnel in the Edmonton, Alberta, Canada area; the equipment used; and the future employment opportunities in the field of data processing.

In addition, this study is being made to identify the beginning data processing personnel; the nature of the jobs performed by them; their experience, education, and methods of training; and the high school courses which have been most helpful in order to obtain and perform the present job. Findings will be used as a basis for making recommendations for possible changes in the business education curricula in Alberta.

II. DELIMITATIONS

The basic data were secured by means of questionnaires issued to beginning data processing personnel and their supervisors. In some cases assistance in interpreting the questions was given either in person or over the phone. Questionnaires were sent to twenty-five data processing installations.

The study was confined to data processing personnel with not more than two years of experience in data processing. The experience need not have been with the firm with which the employee was presently working. The two-year experience limit was fixed since it was thought that a sufficiently large sample could not be obtained from the group with less than this amount of experience. Also, since the study was to determine what was needed by high school students, restricting the experience

to not more than two years kept the study specifically relevant to this group.

Geographically, the study was limited to the companies in the Edmonton area; however, employees of the Provincial Government were not included in the study, due to the unwillingness of the department of revenue to participate.

III. DEFINITIONS OF TERMS USED

Office. The firm's information center engaged in clerical activities for the handling of data and communications.

Office employee. A worker whose primary duties involve preparing, processing, recording and filing communications and information within an office situation.

Beginning data processing personnel. A person who has had not more than two years' experience in data processing.

Data processing personnel. A person whose primary duties involve working with punched card equipment or computers to process data.

Data processing. Handling of information with punched card equipment or computers.

Data processing supervisor. An employee who is designated to oversee the work of others in a data processing department.

Acquaintanceship level. When a person understands the principles involved but lacks the ability to perform a task as a professional or skilled worker.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

I. HISTORICAL DEVELOPMENT OF DATA PROCESSING

The need to classify, communicate, compare and store information is as old as human history. The first data processor was man. In order to meet this need, man developed symbols and sounds. The sounds became more sophisticated and developed into language, as man's problems became more complex.[1] Writing developed through various stages--from stone carvings to the use of paper. In order to meet the needs of today, faster methods than writing are required to record information.

In order to solve numerical problems, man needs ways to count and measure. Counting was first performed on fingers, stones, knotted strings and notched sticks. The first actual mechanical device was the abacus, used by the Chinese thousands of years ago, and still in use in the Orient. It was a refined form of knotted-string idea. Another early method of mechanical calculators was notched sticks from which finally evolved the slide rule.

Napier, in 1617, was one of the first to attempt a manual method of multiplication, called Napier's Bones, or Paddles,[2] which would reduce the possibility of error.

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[1]J. E. Welsh, N. E. Williams, E. E. Barnett, and R. H. Callyer, Principles of Data Processing (Toronto: Sir Isaac Pitman, Canada, 1968), p. 2.

[2]Elias M. Awad, Business Data Processing (Englewood Cliffs: Prentice-Hall, Inc., 1965), pp. 15-22.

In 1642, Pascal of France used a number of gears, which is still a basic principle of modern calculators, and he is often referred to as the "Father of the Calculator." In 1820, Decolman developed a calculator similar to the contemporary rotary calculator. In 1920, Baldwin and Monroe, in the United States, developed a fully automatic calculator, which was run by electricity. In 1899, the Burroughs Adding Machine Company marketed the first full keyboard adding-listing machine. Hopkins developed, in the United States in 1901, the first ten-key adding machine.

During the 1960's the use of the electronic calculator has increased speed and versatility as well as reducing the number of operator's decisions.

The idea of using punched holes as a means of controlling machines originated with a Frenchman, Jacque, who in 1745 used punched holes to control a loom. The holes in a sequence of cards made it possible to weave certain designs in the cloth.

In the 1820's and 30's, Babbage, an Englishman, actually constructed the differential engine and planned the analytic engine. His theories were not put into practice because he could not obtain the precision parts that his machinery demanded. He borrowed the idea of Jaques and was able to make computations controlled by holes in cards.

To meet the growing needs of business and government, mechanical devices were effective; but there was developing an even greater need for faster and more efficient means of processing data.

During the 1800's the population of the United States increased greatly. In 1880 it was recognized that more efficient methods of handling and processing of data were essential if the Census of 1890 was to be completed within a period of ten years. In the 1880's Hollerith, a

statistician, developed a method of recording data in the form of punched holes so that data could be processed faster. In this connection, the first keypunch was used. It was a hand punching device which punched holes in 3" x 5" cards to record data on manually fed electromagnetic counters and sorting box. The census job was completed in two and one-half years, despite the increase in population from 50 million in 1880 to 63 million in 1890.

In 1896, Hollerith organized the Tabulating Machine Company to manufacture tabulating equipment and cards. The company merged with other companies to eventually become the International Business Machines Corporation.

James Power, also an employee of the Census Bureau, designed some card processing equipment. His equipment used 90-column cards and round holes, while the equipment designed by Hollerith used 80-column cards and rectangular holes. At present, the data processing field is dominated by the 80-column Hollerith card.

Strictly speaking, a computer is any calculating device. In this sense an abacus or an adding machine is a computer. However, the term "computer" has come to mean a special type of calculating machine. Some of the typical characteristics and features which differentiate computers from mechanical or electronic calculators are speed, internal memory, and stored program.[3] Whereas in other types of calculating devices, the machine requires human intervention at each step, the computer is

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[3]Gordon B. Davis, An Introduction to Computers (New York: McGraw-Hill Book Company, 1965), p. 2. Note: All historical development of computers was obtained from this publication, pp. 2-92.

automatic in the sense that the stored program will direct long and complicated sequence operations without directions from the operator.

In 1937, Howard Aiken, a physicist at Harvard University, applied the principles developed by Babbage 100 years before and designed a machine that would automatically perform a sequence of arithmetic operations. Seven years later, in 1944, the machine was constructed. It was called Mark I. It was the first automatic sequence controlled calculator, with 72 adding accumulators and 60 sets of switches for setting constants. The machine was instructed by means of switches, buttons, wire plugboards and punched tapes.

In 1945, a group of researchers at the University of Pennsylvania developed a machine which used electronic components. It was called ENIAC (Electronic Numerical Integrator and Calculator). It was much faster than the Mark I, although it did not have the internally stored memory. It was programmed instead by means of switches and plug-in connections. It is often identified as the first electronic computer.

In 1952, a machine called EDVAC (Electronic Discrete Variable Automatic Computer) was developed, which was different from ENIAC in two fundamental ways. The two fundamental differences were the use of binary numbers for electronic arithmetic operations and the internal storage of instructions written in digital form. Its design can be considered as the prototype of serial computers.

The UNIVAC (Universal Automatic Computer) was the first commercially available computer. It went into operation at the Bureau of the Census in the U. S. in April, 1951. In 1954, the first business application of UNIVAC was made at General Electric Appliance Park in Louisville, Kentucky. The word UNIVAC was synonymous with computer for a few

years. In 1953, International Business Machines Corporation installed its first business computer, the IBM 701. Late in 1954 IBM installed an IBM 650 computer which was very popular for the next five years.

The early machines were huge, as they functioned with vacuum tubes. A large amount of power was required to operate these computers and they generated so much heat that air-conditioning was necessary while the machines were being operated. Breakdowns were numerous and frequent. The vacuum tube-operated computers were commonly called first generation computers.

In 1948, the development of the transistor was a great breakthrough in computer manufacturing. The transistor is small, less expensive, generates almost no heat, and requires little power to operate. The transistor-operated computers are commonly referred to as second generation computers. The transistors were first used in military computers in 1956 and in business computers in 1959.

The trend of miniaturization which was set with the development of transistors continued with the advent of microelectronic techniques. It has resulted in smaller and more reliable computer components, called modules. The techniques used to make these modules are solid-state technology and the creation of integrated circuits. The recent developments in computer circuitry have produced monolithic integrated circuits. The computers using these techniques are called third generation computers. The significant dates in the history of computers are:[4]

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[4] Ibid., pp. 21-22.

Date	Event
1812	Charles Babbage and difference engine
1854	George Boole's Laws of Thought
1890	Herman Hollerith's use of punched cards for census
1937	Howard Aiken proposes automatic calculator (completed 1944)
1943	Eckert and Mauchly propose ENIAC (completed 1945)
1944	EDVAC and IAS begun
1948	Development of the transistor
1951	UNIVAC I--first commercially available computer installed at the Census Bureau
1954	First installation of a computer for a business--a UNIVAC I at General Electric Appliance Park
1958-1959	First commercially available transistorized second-generation computers
1963-1964	First deliveries of online-real-time computers
1965	Delivery of computers using integrated circuits

Another advent in the computer development is "online-real-time" system. In a real-time system a request for information is sent to the computer and the result is received back within the time allowed for acting on information. The airlines were among the first users of the real-time system. They maintain a record of all scheduled flights and reservations. A reservation agent can interrogate the computer to determine if the space that a customer is requesting is available.

Another user of the online-real-time system is the banks. The records of all the customers are maintained in a central computer, and input-output devices are installed at each branch. Thus, every transaction, deposit or withdrawal, will be entered into a computer at the time it is made, giving an up-to-date balance of a customer's account at all times.

Trend Toward Office Automation

Probably nowhere in industry are more new ideas being developed, more new methods being tried, and more new equipment being introduced than in the field of business data processing. Much of those areas which

were new and different last year are obsolete today. Data processing is probably the most rapidly expanding field in modern business. More and more companies are entering this field either as users, or as manufacturers, because of benefits and versatility of data processing systems. Applications range from the smallest office to a firm employing thousands of workers, providing accuracy, speed, flexibility, and savings never before realized.

At the time of the writing of this report, the phrase "data processing" is considered synonymous with punched cards or electronic computers. Everybody processes data, whether as a student, teacher, owner of a business, or as an individual. In today's world, the amount of data to be processed in government, science, education, and business has become so great that the aid of the data processing machine is necessary.

Five factors leading to the development of data processing equipment are listed by Awad.[5] First, the physical factor makes it virtually impossible for large business firms to handle all the business transactions. Second, the cost factor illustrates the need for cost control in order to compete. Third, the labor factor indicates that during the past 45 years the increase in clerical help has been four times greater than the increase in factory help. Fourth, the error factor reveals that data processing equipment can eliminate errors which can be caused by human beings due to dull mechanical operations, carelessness, boredom and environmental conditions. Fifth, the speed factor shows that data processing systems can provide information in order to make on-the-spot decisions.

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[5]Elias M. Awad, op. cit., p. 4.

The importance of rapid and accurate decisions cannot be over emphasized in today's business world. Business data processing systems are designed to meet this need. If the source data is prepared correctly and the instructions to the machine are correct, the machines can produce the results very quickly and with perfect accuracy.

So new is the field of data processing that the Computer Society of Canada had no comprehensive definition of computer until 1968. It was in 1968 that the society was able to define a computer. According to the society, "A computer is a device capable of accepting, processing and supplying data under the control of an internally stored program which it has the ability to modify."[6] The lack of such a comprehensive definition is one of the basic reasons for discrepancies in computer statistics provided by various organizations and individuals. Every year the Computer Society of Canada has prepared statistics about the computers in Canada without really knowing what equipment should be included or excluded. If the above definition had been used in the 1967 census of computers in Canada, it would have excluded 98 machines that were enumerated and the total would have been 1,285 instead of 1,383.

The phrase, data processing, is a modern term. The term is so new that Webster's New Collegiate Dictionary, 1961 edition, has no such word or phrase called data processing. The same dictionary does not have the word computer in it, but the activity of data processing is as old as human history. The word data means "facts"; data processing, therefore, is handling and using of facts.[7] Throughout human history

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[6]News item in the Toronto Globe and Mail, January 4, 1968.

[7]Beryl Robichaud, Understanding Modern Business Data Processing (New York: Gregg Division, McGraw-Hill Book Company, 1966), p. 2.

people have been processing data. Data may be almost anything and everything. Data may consist of names, hours worked, ages, phone numbers, or grade level. But the phrase data processing is usually associated with unit record equipment, punched cards, and electronic computers. Abram and Corvine[8] have defined data processing as the handling of data through the use of machines.

In this study the phrase data processing is used as the handling of facts with unit record equipment, tabulating machines and computers.

With the advancement of technology, the modern day computers are smaller, less expensive and more versatile. In 1951, the U. S. Bureau of the Census installed the UNIVAC I, the first commercial computer, and it was not until 1954 that the first business computer was installed. The growth of computer applications has been very rapid. By 1964, after a short period of only ten years, there were more than 13,000 nonmilitary computers, not including electronic card processors, in the United States.[9]

Time, in its December 29, 1961 issue, reported that there were 9,000 computers in the United States and 500 in Canada. The United States had 76 percent of the "free world's" computers.[10] In 1966, Sarnoff stated that there were 30,000 computers in the United States, and he predicted that by 1976 the number of computers would reach 100,000.[11]

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[8]Peter Abrams and Walter Corvine, Basic Data Processing (New York: Holt, Rinehart and Winston, Inc., 1966), p. 1.

[9]Gordon Davis, op. cit., p. 24.

[10]"Automation Speeds Recovery, Boosts Productivity, Pares Jobs," Time, Canadian Edition (December 29, 1961), p. 50.

[11]David Sarnoff, "No Life Untouched," Saturday Review (July 23, 1966), p. 22.

In Canada the growth of computers has also been rapid: from 710 computers in 1965, to 948 in 1966, 1,279 in 1967, and 1,613 in 1968.[12] Out of the total 1,613 computers in Canada, 50 percent were in Ontario, 25 percent in Quebec, and 07.4 percent in Alberta. With 119 machines, Alberta has ranked third in computer population among the provinces. Calgary, Alberta, has the biggest per capita investment in computers in North America to conduct the geological interpretation by oil companies.[13]

Manufacturing firms had about 400 computers in Canada, which is about 25 percent of the total. The computer installations in other segments of the economy were: 234 other services, 191 financial, 186 government, 128 distribution, 80 utility, 77 petroleum, 115 service bureaus, 60 transportation, and 50 primary resources.

Slow growth of computer installations in Canada, in comparison to the United States, is due to some special problems. In Canada computer installations and rental costs are higher than in the United States. On the other hand, clerical costs are lower in Canada than in the United States. Another problem is the lack of skilled programmers and other data processing personnel. The third problem is the lack of standby equipment, in case of breakdown, for users in remote areas.

Most of the research reviewed indicates that the trend of office automation will accelerate rather than slow down in the near future. It is generally believed that in order to compete in the future, computers will be a necessity for most businesses irrespective of the size of the

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[12]G. S. Glinski, "Computing in Canada," Datamation (September, 1969), pp. 70-71.

[13]Paul Jackson, "Computer Service: Fantastic Growth and a Few Pains," Alberta Business Journal (June, 1969), p. 41.

firm. In 1880, there were 50,000 telephones in use and there are slightly more than 50,000 computers in use today.[14] As no major business enterprise survived without the telephone in the past, no business in the future will succeed without the computer.

The manufacturers of computers have realized the potential market for small machines. Small and rather inexpensive machines are now on the market, which bring the computer facilities within the reach of medium-sized businesses.

A. E. Courley,[15] an accountant, writes that excellent small computers can be rented for about $20,000 a year. As of December, 1968, one-half of 74,000 computers installed internationally and two-thirds of the 25,000 on order rented for $5,000 per month or less.

The introduction of simple programming techniques and languages, coupled with small and inexpensive computers, makes it possible for small firms to make use of the computer facilities of electronic data processing which were beyond their reach a few years ago. A small computer will have, G. de Sabata writes, a monthly rental fee of between $1,000 and $3,000.[16] More than half of the computers in the United States are small-scale machines, and by 1980, of the estimated 85,000 computers in use, 60,000 will be classified as small.

The business firms which cannot afford their own electronic data processing facilities will be able to make use of the facilities of the

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[14]"Keeping Alive in the Computerland," Business Management (May, 1969), p. 19.

[15]A. E. Courley, "Should You be Using One?" Alberta Business Journal (March-April, 1969), pp. 18-19.

[16]G. de Sabata, "Computer Application for Small Business," Advance Management Journal (January, 1969), pp. 51-55.

computer utility companies. The research cited indicates that the trend in the future will be a continuous growth of computer service centers. There are many factors which will encourage the growth of these firms.

Even though the computers are becoming smaller and less expensive, the lack of trained programmers and data processing personnel is one of the biggest factors which will force the small and medium size businesses to use the facilities of the data processing centers rather than having their own facilities. The second factor which will encourage the growth of the computer service bureaus is the availability of powerful computers, which can handle the work for a large number of customers. Thirdly, the expensive software and programs will encourage the growth of the computer utilities companies. The fourth factor, says Glinski,[17] is the glamour of the new industry. The field of computer service is already overcrowded in Canada, but many new companies of this nature will emerge in the near future as the stock promoters will push the stock of this glamorous industry.

Success of new companies in the computer service field is not assured; competition is already keen. Jackson[18] outlines the success of some of the computer service bureaus in Alberta but cautions that new and small firms may not stand the competition due to proliferation of facilities.

A computer utility company cannot merely dispense raw computer power, like other utilities: it must provide software and programming

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[17]G. S. Glinski, op. cit., p. 71.

[18]Paul Jackson, "Computer Service: Fantastic Growth and a Few Pains," Alberta Business Journal (June, 1969), pp. 41-44.

facilities. In most cases it will be within the ability of most of the business firms to acquire their own hardware; however, it will be the inability to acquire software, qualified personnel, and peripheral services which will force the small and medium size firms to make use of the computer utilities services. "Already more is spent on software and other computer services than on hardware. And experts predict software may grow twice as fast as hardware."[19] Computer service companies will be able to spread the software and payroll costs over a large number of customers, thus making it cheaper for the users to use the facilities of these firms rather than their own.

The continuous scarcity of trained programmers and other data processing personnel is one of the major factors for the success of the computer service companies. At present, in the United States, the annual supply of programmers is 25,000 under the demand.[20] As mentioned earlier, there is a shortage of trained data processing personnel in Canada. Alberta will need approximately 1,000 new programmers by 1975, but the current facilities will train only 400.[21]

In the future, the trend will be specialized computer service organizations. Computer service bureaus will provide automatic interchange of information between service organizations and among the users. At present there are over 1,000 computer utilities in the United States.[22]

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[19]"Computer Software Companies: How Many Are Houses of Cards?" Forbes (February 15, 1970), p. 40.

[20]Ralph Zani and William M. Zani, "Towards the Computer Utility: Evolution or Revolution," Datamation (October, 1969), p. 125.

[21]Paul Jackson, op. cit., p. 44.

[22]Dale Mayo, "The Coming Shake-Out in Software," Business Management (May, 1969), pp. 21-23.

Computers are designed to process data and solve problems. They do this very quickly. The speed at which a computer can perform mathematical operations is difficult to imagine. Speed and capacity are the essence of computer efficiency. The first generation computers were capable of performing in a microsecond; and the third generation computers can do it in a nanosecond. In order to make the optimum use of a computer's capability, jobs are generally fed into it in large batches.

There are numerous tasks which take only a short period of computer time but require frequent use of the machine. A programmer, for example, might need a computer to test run the program which he is writing. Similarly, an engineer, a financial analyst, a market researcher or other highly paid personnel has to wait until the routine batch processing is completed. This might take hours, or sometimes days, to get an answer to a problem which might take only a minute of computer time.

A time-sharing system is designed to take care of such situations. It allows many individuals with small or occasional problems to use the computer without waiting. It makes possible the most economical utilization of the time of highly paid personnel. It also permits the batch process jobs to be performed concurrently.

To all the users, which might be a dozen or more, the computer is always available for work. They can call the computer from the remote control terminals, give it the problems and in a few seconds or minutes they have their answers. The jobs are performed so quickly that no user has any impression of waiting. The hardware and software are designed for multiprogramming to fully utilize the capabilities of the computer.

In most cases a library of hundreds of prewritten programs is always at the disposal of the user. The user of such a remote control

terminal can learn to communicate with the computer after a few hours of practice.

According to Cutler,[23] the main advantages of time-sharing, as generally agreed upon by the suppliers of the service, are:

Ease of accessibility through either a teletypewriter or small scale computer;

Ease of use through one of the many conversational computer languages;

Speed of operation of 10 characters a second on teletypewriters and high speed printer speeds on small scale computer terminals;

Flexibility in calculations that can be performed using large prewritten program libraries or proprietary programs;

The need for little or no extra staff to operate the terminal facility;

The low cost of the service, which can be as low as $200-$300 a month. According to Computer Sharing of Canada, the average cost to their customers (and, they believe, for the entire time-sharing field) would be $750 a month;

The suppliers also claim their service is suited to the company with its own in-house computer operation. In this case, they say, the service can be used:

To write, debug or convert programs to be run on their own systems;

To relieve the pressure on an over-worked computer;

To assist companies changing their present computer to one made by a different manufacturer;

For quickest turn-around time on processing jobs that would otherwise have to go through a number of time-consuming stages before it is actually run on an in-house system; and

To acquire added sophistication at low cost.

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[23]Bill Cutler, "Time-Sharing's Growth Offers You Large-Scale Computing Through Low Cost Terminals," Office Equipment and Methods (February, 1969), p. 70.

Computer time-sharing will bring electronic data processing facilities to more and smaller companies. Canadian General Electric has been offering time-sharing services in Canada since March, 1966.[24] Now many firms are providing such a service and many more will be formed in the near future.

The expansion of time-sharing facilities is significant enough that the computer service bureaus, which provide batch process facilities are threatened by their new competition. The time-sharing companies are ready to offer both remote batch processing facilities and also online-real-time processing of data through remote control terminals. Though developed in the late 1950's and early 1960's, computer time-sharing began in earnest only a year ago.

Time-sharing of computer facilities may be the answer to their excessive cost, which is the most common objection of business education to offering advanced level data processing programs in high schools. Until now, the institutes which offer programming courses test student-written programs under a batch process system. The programs written by students are collected and processed as a batch in order to make the most efficient use of the computer. This method sometimes may result in a delay of several days before the student will find out the mistakes in his program. By using a time-sharing service two or three terminals could effectively service several hundred students. The student keys in his program at the terminal and the computer will immediately indicate where mistakes have been made. The greatest advantage of this method of

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[24] Ibid., pp. 52-53.

teaching computer programming is the immediate feedback, which is essential in an effective learning situation.

The cost of renting time-sharing service is within the reach of all the school districts. According to Phil Humfrey, the president of Polycom Systems Ltd., the user pays an average total cost of $14 per hour every time he calls the computer.[25]

II. LITERATURE MOST CLOSELY RELATED TO THE PRESENT STUDY

Many investigators have given attention to the opportunities for beginning office workers. The investigations also include the demands made of office workers and the educational training which may prove of greatest benefit to them. In most cases these studies are related to beginning office workers. Very few studies dealt specifically with the data processing employees and high school programs in data processing.

Both the number and varying emphasis of studies dealing with competency needed by the beginning office workers clearly indicate the importance which educational researchers assign to this aspect of the total business education field, and the individual study complements other research in the same area. No total picture emerges; however, far more research remains to be done.

The reviewed investigations focused on entry-job opportunities, competence required for specific jobs, and the duties and preparatory qualifications of the general office work. Certain studies synthesized employment need as expressed by employers.

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[25]Ibid., p. 60.

The reviewed studies used questionnaire or interview techniques for data collection. The majority of the investigators used the questionnaire technique, realizing that either method has its advantages and limitations.

The studies revealed that most entry jobs occur with major employers. Most of the beginning office workers were employed by finance, real estate, and insurance firms.

Most studies favored school preparation for beginning office jobs. Research also revealed that most schools could improve their business education programs.

Since the Second World War the number and the ratio of the white-collar workers have been increasing over the blue-collar workers. In 1956, for the first time, the number of white-collar workers exceeded that of the blue-collar workers.[26] Among the white-collar workers, the growth of clerical workers has been most impressive. Wenner[27] outlines the growth of clerical workers in the United States. One out of every eight employed workers in the United States in 1950 worked in an office. This was a marked increase from one in twenty in 1910, and one in ten in 1940. In 1955, one out of every seven employed persons was an office worker.[28] At present the ratio is still about one out of seven.

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[26]Dale Yoder, Personnel Management and Industrial Relations (Englewood Cliffs: Prentice-Hall, Inc., 1962), p. 41.

[27]James F. Wenner, A High School Orientation Course in Data Processing (Cincinnati: South-Western Publishing Company, 1966), p. 1.

[28]National Office Management Association, Clerical Employment Trends in the Office (Willow Grove: The National Office Management Association, 1958), p. 5.

In the 1960's clerical employment has grown slowly, but it is still increasing faster than the work force as a whole. It is estimated that by 1970 there will be more than 12 million clerical workers in the United States.[29] Clerical employment in offices may reach 14 million in 1975,[30] or about 14 clerical workers for every 10 employed in 1963.

At the turn of the century the primary function of the economy was the production of goods. In the 1960's the primary function of work in our economy is the distribution of goods and the provision of facilitating services. It is the function of the office to provide such facilitating services.

In 1900, 70 percent of the labor force was engaged in the production of goods, compared with only 40 percent in the 1960's. Clerical workers have increased from 3 percent of the total labor force in 1900, the lowest among all occupations, to 14.7 percent in 1960.[31] It is projected that by 1975 clerical workers will make up 16.2 percent of the labor force in the United States, making it the largest ratio among all other occupations. It is estimated that the clerical workers will increase by 45 percent from 1960 to 1975.[32]

Similar trends are apparent in Canada. Over the past 25 years there has been a large increase in the ratio and the number of office

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[29]Wenner, op. cit., p. 1.

[30]John C. Roman, The Business Curriculum (Cincinnati: South-Western Publishing Company, 1966), p. 45.

[31]Grant Venn, Man, Education and Work (Washington: American Council on Education, 1964), p. 8.

[32]Ibid., p. 18.

workers in the Canadian labor force. In 1968,[33] clerical workers in Canada accounted for 14.1 percent of the total labor force, the highest of all occupations. This is a marked increase from 10.2 percent in 1948, 11.3 percent in 1953, 12.6 percent in 1958, and 13.4 percent in 1963. According to Canada Yearbook 1968, since the Second World War there has been a significant change in occupational distribution.

> There was a larger increase in the number of office workers than in the number of craftsmen, production process, and related workers in the post-war period, reflecting the changing composition of final output and also the introduction of new methods of production.[34]

The proportion of clerical workers is higher for Edmonton than the national average. In 1959, there was one office worker for every six members of the labor force.[35]

In spite of the increased use of automated equipment, the need for office workers did not diminish. However, there has been change in the skills and education required by the office workers.

In its 1967 report to the membership, the Data Processing Management Association revealed that this new industry, data processing, has created more than 6,000 new types of jobs which did not exist 15 to 20 years ago. It projects employment for 75,000 persons in the field of electronic data processing by 1972.[36]

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[33]Dominion Bureau of Statistics, Canada 1968 (Ottawa: Dominion Bureau of Statistics, 1968), p. 759.

[34]Ibid., p. 751.

[35]Malcolm E. McDonald, "A Survey of the Types of Office Machines in the Edmonton, Alberta Community for the Purpose of Designing Appropriate Office Machines Instruction" (Unpublished Master's thesis, University of North Dakota, 1959), p. 36.

[36]Data Processing Management Association, Report to the Membership (Mount Morris: Data Processing Management Association, 1967), p. 12.

There is an acute shortage of trained personnel at all levels of data processing. A recent review, by the Association of Data Processing and Computer Management,[37] of want ads in the major metropolitan newspapers showed a continuing demand for electronic data processing personnel. A New York newspaper carried almost three and one-half pages of advertisements, seeking 705 operators, programmers, systems men, and managers. A Chicago paper carried 146 advertisements, and a Cleveland paper had 98. An increasing number of jobs asked "some experience." Advertisements for keypunch operators and female help were only 10 percent of the total in each case.

The research reviewed indicates that most business firms believe there is a shortage of data processing workers. A survey conducted in the Charlotte-Mecklenburg, North Carolina,[38] area revealed that 76 percent of the firms noted a shortage of data processing employees. The greatest shortage appears to be of programmers, keypunch operators, and machine operators--in that order.

There appears to be no research available which is similar to the present study. Some closely related studies were cited. One survey study of the types of office machines in the Edmonton Community was conducted in 1959. In this study the punched-card machines were excluded for the following reason:

> The various types of auxiliary punched card machines and electronic data processing machines have not been examined in detail. These machines are so varied and complex that a

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[37]"Disk 'n Data," Journal of Data Management (February, 1967), p. 3.

[38]John M. Bunch, "Survey Shows Need for Data Processing Instruction," Business Education Forum (March, 1969), p. 27.

> detailed examination of them is impractical in a study of this type. However, because of their growing importance and use, these machines have been considered to a limited extent.[39]

The same study revealed that there were 47 employees in Edmonton who operated various keypunch machines. Forty-four of these workers were in large establishments, three in medium-sized, and none in small. All of the keypunch operators were full-time operators.[40]

Due to the short demand for the keypunch machine operators and the expense involved it was suggested that, "Machines such as the keypunch machine, teletypewriter, and complicated bookkeeping machines are too specialized and expensive for use in Edmonton High Schools."[41]

A survey was conducted by Godby,[42] of the Pekin-Peoria, Illinois, area, to determine the type of job opportunities for workers in data processing installations. The jobs available were: keypunch operator, card tape converter operator, coding clerk, data typist, high speed printer operator, tabulating record control clerk, chief tape librarian, teletype operator, and flexowriter operator. In small data processing installations an employee may be expected to perform several jobs. The greatest number of workers were employed as keypunch and verifier operators, and most of them were women. These two positions accounted for 35 percent of female workers. Tabulating and auxiliary machine operators were mostly men. Of the total 431 data processing workers, 370 or 86

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[39]McDonald, op. cit., p. 2.

[40]Ibid., pp. 128-131.

[41]Ibid., p. 146.

[42]Carolyn Godby, "Clerical Employees in Data Processing Occupations," The Balance Sheet, XLVII (October, 1966), 59-60, 93.

percent were women and 61 or 14 percent were men. Keypunch operators constituted the largest number of workers hired in these installations during the previous year.

Wenner[43] conducted a survey of 144 business firms using mechanical and electronic data processing equipment in the Iowa area. The survey was to determine what types of job opportunities were open to recent high school graduates who had no previous data processing education or training.

It was reported in the study that the minimum age requirement by the majority of the respondents for keypunch and verifier operators, and tab equipment operators was 18 years. For all other job classifications there was a wide range of requirements. Women were predominant in two job categories--keypunch and verifier operators. Over 65 percent of the firms wanted only males for five job classifications--electronic data processing analysts, punched card method analysts, tab equipment supervisors, and maintenance technicians. Also, for the above five categories, the respondents often required the applicants to be college graduates.

It was found that there were equally as many jobs available for men as there were for women.

The study revealed that for all 12 job categories firms were almost unanimous in requiring high school graduation as a prerequisite to employment. Only two firms made an exception for keypunch operators. Between 25 and 55 percent of the firms had no specific high school business course requirements for new employees in data processing. Only 50

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[43]James F. Wenner, A High School Orientation Course in Data Processing (Cincinnati: South-Western Publishing Company, 1966), pp. 6-27.

percent of the firms required keypunch and verifier operators to have typewriting in high school. The respondents were asked to list the minimum business education requirements for data processing employees for each of the twelve job categories. The business education programs in high school listed were: secretarial, clerical, bookkeeping, general business, and typewriting. In only one category did more than 50 percent of the business firms surveyed agree on one business education program as being the most important. The program was typewriting for keypunch and verifier operators.

In all 12 job categories, more than 25 percent of the firms had no specific requirements concerning the particular business education program offered in high school. "No specific requirement" was answered more often than any other requirement. The most frequent requirement for all of the job classifications was a general business program. Over 30 percent of the firms listed general business education as a prerequisite to employment. Bookkeeping was required from 20 to 30 percent of the firms. Of the five business education programs, secretarial was required the least often. It appears that the wider background of knowledge, which the students get through general business programs, is considered more important than the specific skill for employment in a data processing installation.

College education does not seem to be an essential requirement by most of the firms for most of the jobs. A college degree was considered to be a minimum requirement in 8 to 40 percent of the firms, but for only four job categories. It was interesting to note that no particular college major was an important factor for hiring new employees.

Only 30 percent of the firms required electronic data processing experience for new employees. The firms which had electronic data processing experience as a prerequisite generally agreed to 12 months experience for most of the job classifications. There were several exceptions and variations. Over one-third of the firms required some electronic data processing experience in eight job classifications. For only one category, tab equipment operator, less than 10 percent of the firms required some experience in electronic data processing.

Even though a general business education program was preferred by 70 percent of the firms, the general business experience was not very highly rated. Of all the firms surveyed, 75 percent did not consider that general business experience was essential.

Two categories, auxiliary equipment operator, and maintenance technician, did not require experience by any firm. The firms which required general business experience for the other ten job classifications suggested 12 months of such experience as most desirable.

The study revealed that previous secretarial experience was not required. Only one firm required 12 months secretarial experience for tab equipment supervisor. "Obviously the consensus of the business firms surveyed is that secretarial science education in the high school or secretarial experience is not necessary for applicants for positions in the field of data processing."[44]

Similarly, very few firms indicated that clerical experience was important for the prospective data processing employee. No firm required any clerical experience for the positions of electronic data processing

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[44] Ibid., p. 18.

analyst. For the other eleven categories, one to four firms required three to 48 months of clerical experience. It was also reported that accounting experience was not deemed necessary for employment in most of the jobs. The experience in general business, clerical, secretarial and accounting was of little importance in the employment of data processing personnel.

There was a great variety of requirements in terms of the number of months of the tab equipment experience. Only 10.8 percent of the firms required this type of experience for keypunch and verifier operators, and a maximum of 42.4 percent of the firms sought experience for the tab equipment supervisors.

> Fifteen to 46 percent of the firms require new employees, in the twelve job categories, to attend their company school from one to twenty-four months, and 19 to 70 percent of the firms require new employees, in each job classification, to attend an equipment manufacturer's school from one to twelve months. Vocational schools were not considered an important source for training employees.
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> It is important to note that a high percentage of firms require their new data processing employees to attend either a company school or an equipment manufacturer's school. This certainly indicates that education and training is almost a necessity for new employees in the field of data processing. It should also be noted that the lack of certain requirements on the part of the business firms surveyed does not necessarily indicate that positions in data processing can be easily secured.[45]

Another study which is most closely related to the present investigation is a survey of beginning office workers,[46] conducted by Malsbary in Connecticut. The study revealed that most of the beginning office

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[45] Ibid., p. 27.

[46] Dean R. Malsbury, A Study of Beginning Office Workers in Connecticut (Hartford: Division of Vocational Education, State Department of Education, 1967), pp. 113-120.

workers are females, single and 18 or 19 years of age. Most of these workers held clerical types of jobs and had no previous office experience before starting with the present employer.

Most companies did not provide on-the-job training so most of these workers were expected to produce upon being hired. They did not have any training beyond high school and they did not intend to continue any such training in the future. The respondents reported that all business education subjects studied in high school had been helpful and no business subject should be omitted from the high school curriculum. The business education program which the beginning workers took in high school met their on-the-job needs quite well. It was also reported that they would take more business courses if they were to repeat high school.

Typewriting and clerical office practice courses were considered of greatest value, and of the nonbusiness courses taken, English grammar, English composition, and general mathematics were thought of most help. They felt that many of the business abilities and knowledge they possess are not being made full use of in their present positions.

Typewriting was taken by 83 percent of the respondents, bookkeeping by 58 percent, shorthand by 46 percent, and business arithmetic by 36 percent. These four courses were taken by more interviewees than any other courses. Most of the beginning office workers were engaged in filling in or completing blank forms, filing of correspondence and other records, and typing letters and reports from rough draft.

The most commonly used pieces of equipment were ten-key adding machines, photocopying machines, full-keyboard adding machines, and typewriters. The ten-key machine was used by more workers than any other equipment. Equipment, such as billing machines, was used by a few

employees for a great part of the day; whereas, machines such as adding and photocopying were used by many workers, but for very little time each day.

Two most important personal characteristics cited by the beginning employees were accuracy in work and sense of responsibility. The other characteristics which beginning office workers considered important included: regularity of attendance, dependability, neatness of work, organization, and ability to work well with supervisors.

Among the skills, knowledges, and understandings, the beginning workers rated the ability to write numbers legibly, spell correctly, and perform basic arithmetic operations among the top three. The most desirable strengths of the beginning office workers, as seen by their supervisors, were: general typing ability, ability to interact with people, speed of learning, pleasing personality, general knowledge of business, terms and concepts, and general mathematics. There were many variations and differences; the characteristics cited as strengths by some were listed as weaknesses by other supervisors. The most common weaknesses listed were: lack of maturity, poor attendance, and tardiness.

It has been always an urgent question among educators as to what should be included in a course of study, and who should take such a course. In the past, curriculum development in business education has received considerable attention, and many studies have been conducted to determine and update the curriculum of business education. One of the purposes of this study is to recommend changes in the business education program in Alberta.

One misconception which was held for a long time by the educators and the general public at large, but which is now falling apart, was

that an electronic data processing employee needed an extensive background in mathematics. A study conducted by Bang and Hillestad revealed that an extensive background in mathematics is not essential in order to be successful in data processing.[47] The employers were looking for logicality in data processing personnel. For the employees to be successful, the knowledge of the total system was considered essential rather than isolated skills and understandings. The students should also understand the various areas of business--marketing, finance, accounting, production and management. It was noted that successful personnel were: intelligent, accustomed to thinking, independent, systematic, used to solving puzzles, and willing to do overtime work.

The authors noted that the future changes in computers will be in input-output devices and other peripheral equipment rather than in the computers. The lower cost and greater memory of the computer will make the task of programming easier. It will take less training time for programmers than we have thought necessary in the past.

Most educators are still uncertain as to the best place for data processing in the business education curriculum. Researchers and leaders in business education agree, and this agreement seems to be unanimous, that data processing should be taught in high schools. The consensus is that if it is not possible to teach a full program in data processing, a unit in modern data processing and automation should be incorporated in one of the business education courses.

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[47]Kendrick F. Bangs and Mildred Hillestad, "Curriculum Implications of Automatic Data Processing for Educational Institutions," Research and Development, Fred S. Cook and Frank W. Lanhan, Business Education World (September, 1968), p. 5.

Bookkeeping seems to be the most favored and logical subject to integrate data processing. Since bookkeeping is a manual form of data processing, therefore, it is natural that the concepts of automation should be applied to bookkeeping. According to Haga,[48] the philosophy of automation, if not the tools, should be incorporated into bookkeeping courses. Separate familiarization courses in punched card data processing and computer should also be offered. Bookkeeping and automation are so closely related that they cannot be separated.

An introductory course in data processing and automation need not be designed to prepare students for positions in automated data processing. It should become clear to the students that data processing is certainly no end in itself, but merely a device leading to, or supporting other business activities. The students should not be expected to become experts in punched card accounting or become computer operators. They should acquire an understanding of concepts of automation and electronic data processing.

In order to gain full benefits from equipment and the ideas of electronic data processing, the data processing should, according to Yourd,[49] be integrated with accounting courses. The concept of a bookkeeping cycle should be related to flow charting in data processing.

To most students, computers are mysterious machines with huge capacity and speed. A unit in automation, points out Hanna,[50] will

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[48]Enoch J. Haga, "What Automation Means for Bookkeeping," Business Education Forum, XX (December, 1965), 14-15, 18.

[49]Bryce W. Yourd, "Accounting, Data Processing and the Psychology of Learning," The Balance Sheet, XLVII (May, 1966), 389-393.

[50]Marshall J. Hanna, "Can Automation be Taught in Bookkeeping?" Business Teacher, XLI (November-December, 1963), 5.

provide an understanding of concepts and terminology of automation. This will provide a realistic outlook to the students about automation and they will realize that automation is only a method and not a machine. It will make automation less mysterious and awesome to the beginning office workers.

An introductory unit in automated data processing is a must, writes Kahn, for high school students. The students should realize that computer and peripheral equipment is just an extension of manual and mechanical systems. Such a course could be of three or four weeks duration. The objectives should be to develop an acquaintanceship with fundamental operations performed; familiarity with various techniques, equipment, vocabulary, and terminology; and awareness of impact of automation on society, economy, business, and jobs.[51]

Freeman[52] points out that the most logical time at which to introduce data processing in an accounting course is after the students have gained a thorough understanding of accounting principles and an appreciation of the basic accounting cycle. Students should be acquainted with what is meant by data processing and the terminology used in the field. The terms input, output, recording, classifying, etc., should be related to the accounting terminology. Similarly, the operations of the accounting cycle should be related to data processing. E. S. Dodson also recommends the introduction of data processing after the students have studied bookkeeping for one year. He advocates that

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[51]Gilbert Kahn, "Take the Mystery out of Data Processing," Business Teacher, XXXXIV (September-October, 1966), 6-7.

[52]Herbert H. Freeman, "Teaching Data Processing," Business Education World, XXXXIX (June, 1969), 15.

data processing training should be concurrent with advanced accounting.[53] It is obvious that the purpose of such a program is not an orientation course in data processing but to prepare students for vocational competency.

A course or a major unit in data processing should be offered on the high school level. It is not easy to establish such a course in most high schools, points out Godby[54]; however, the clerical practice teacher should include a unit in data processing. The purpose of such a unit should be to provide general background information and to develop vocabulary. The types of equipment available should be studied through field trips. The students should also be made aware of the job opportunities in the field of automation.

Most students graduating from high school will not be data processing machine operators or technicians, but most will find employment in businesses where data is processed systematically. The chances are that the businesses in which these students will work will have electronic data processing facilities. Some educators, therefore, recommend that in high school all students should be offered an acquaintanceship level program in electronic data processing and communication channels of business. In high school the students should be made familiar with equipment used in data processing installations, and vocational level competency should be left for post-high school institutions. It is felt

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[53]Edwin S. Dodson, "A Data Processing Course Lowered Our Dropout Rate," Business Education World, XXXXVI (April, 1966), 22.

[54]Carolyn Kuntzman Godby, "Preparing for Data Processing Occupations," Business Education Forum, XXII (February, 1968), 8.

that specialized training is an almost impossible task for a small high school.

It is summarized by Kallaus,[55] that a student should learn about the entire information process and the role that a data processing machine plays in a system. The student should examine the components of the system in order to analyze the functions to be performed, machines to be used, and the functions which man can perform better than machine. It is possible to integrate a unit in data processing in every business and related high school course.

On the other hand, some business educators feel that the vocational level of data processing belongs in high school. One of the major reasons for students dropping out of high school is their disinterest in their programs of studies. To provide incentive for the students to stay in school and graduate, more meaningful programs should be offered.

Vocational business education belongs in high school and it should not be postponed for post-high school studies. The students should be encouraged, according to Gruber,[56] to take one or more vocational business subjects in high school, in a skill which can be used to obtain part-time employment during both high school and college years; to obtain full-time employment if desired upon graduation from high school, and to explore one's own interests and abilities.

A three semester data processing program was offered in Evanston Township (Illinois) High School, during 1967-1968, to 500 students. The

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[55]Norman F. Kallaus, "Integrating Data Processing Concepts in Business Classes," Business Education Forum (March, 1968), p. 22.

[56]Joseph Gruber, "Delay Vocational Business Education? An Emphatic No!" The Balance Sheet, XLVII (October, 1965), 54.

course was conducted by three qualified teachers who had a full line of unit-record equipment and a complete IBM 1401 computer system at their disposal. A sequential three-course program, each of one semester, was offered: (1) Data Processing, (2) Computer Programming I, and (3) Computer Programming II. "Hands on" experience and practical application was emphasized. Several students demonstrated exceptional proficiency. These students are currently employed on computer operations as programmers and systems analysts. Many other students were employed as keypunch and tab operators. It was found that the students trained in this program were employable.[57]

The research work cited indicates that a vocational level data processing course has always been a success. One program reported by Dodson was conducted in Earl Wooster High School in Reno, Nevada. It was reported that the students who had been given a zero prognosis for high school completion finished high school after data processing and computer programming were introduced.[58]

It was noted through the study of the research that whenever "hands-on" experience and on-the-job experience were given to the students, the training time was cut considerably. In January, 1968, a program to teach computer concepts and operations was conducted for the disadvantaged youth for the Oakland Neighbourhood Youth Corps.[59] The

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[57]W. G. Carpenter and R. L. Nickels, "Setting up a Successful High School Data Processing Program," Business Education World, XLVIII (May, 1968), 9-11.

[58]Edwin S. Dodson, op. cit., pp. 20-22.

[59]Phillips H. Braverman, "A Program of Computer Operator Training for the Disadvantaged," Datamation (November, 1969), pp. 272-274.

course lasted over three weeks; a total of 12 sessions, each session three hours in length. After this short training in the classroom, the students were placed for on-the-job training. Work time varied from 10 to 30 hours per week, and it lasted anywhere from three to six months. After the on-the-job training, many students were absorbed by the companies in which they had served their apprenticeship.

Two more classes were held in the same year and 36 additional students were trained. These classes were held full time for two weeks and emphasis was again given to "hands-on" machine experience.

The second phase of the program was with the Adult Opportunity Center; the classes were held in the evening and 84 students were graduated. The dropout rate was only 8 percent. Again, "hands-on" equipment was stressed. The Adult Opportunity Center was successful in placing 70 percent of the graduates in the data processing jobs with an average monthly salary of $475.

The researchers encountered the following problems: A high level of formal education is required in order to be successful in such a program; current employees from other departments have first chance at any data processing jobs available; some trainees' salaries were lower than welfare payments; women have less opportunity in operations because of heavy lifting and late shift requirements, and openings do not correspond to the graduating class abilities.

Training in electronic data processing is available not only in educational institutions but also at other places. A program was instituted to teach electronic data processing in 1967 in the Washington State Penitentiary. The school accepts inmates with a high school diploma. Rigid selection procedures and curriculum are followed. The

classes are conducted as near to on-the-job conditions as possible. The program allows the inmates to earn an associate degree in applied science through affiliation with community colleges.[60]

A high school data processing program, recommends Kargilis, should not be restricted to only one level of competency. "All levels of data processing can be implemented: Acquaintanceship, integrative, vocational and a combination of the preceding."[61] He believes the acquaintanceship level course should be only an introduction to the basic concept of electronic data processing. Such a course should describe the hardware used, interpretation of the Hollerith code, and the importance of flow charting. The integrative approach is the "buckshot" method. In such an approach the data processing concepts should be integrated into traditional business education subjects. The third level, vocational, should be taught to develop marketable skills for entry jobs in data processing installations. The three levels mentioned above can be combined, depending upon the facilities available. The students can gain understanding of data processing combined with vocational competency in the operation of keypunch machines. Another possibility is the introduction of computer programming in the second year bookkeeping course. The kind of data processing course which should be offered will depend upon the needs of the student, school, and community. "A categorical statement which purports that only a general understanding of data processing should be presented may thwart the efforts of business

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[60]Gordon Graham, "The Washington State Penitentiary Electronic Data Processing School," Datamation (July, 1966), pp. 85-86.

[61]George Kargilis, "Data Processing a Must for the High School," Business Education Forum, XXII (May, 1968), 14-16.

education to identify its role in a world when man and machine are in constant change."[62]

Some educators recommend that an introductory course in data processing should not be restricted to business education students, but may be an elective for all those students who want a background in automation and electronic data processing. The basic concepts are so similar at the introductory level, points out Haga,[63] that such a course should be called Introduction to Data Processing rather than Introduction to Business Data Processing.

The future input-output devices will undergo a considerable change. According to Corcoran, it is estimated that at present, there are 500 optical character recognition units in use. By the very early 1970's there will be 5,000 of these devices in use in the United States.[64] Corcoran also remarked that the punch card is obsolete and there has not been a major computer installation with punch cards in over a year. The business educators should watch the prediction concerning future equipment and employment trends. In the early 1960's it was felt that the future need for keypunch operators would decrease and that the business world would not need any more. The opposite has proven to be true. The demand for keypunch operators has been increasing. The present threat that optical character recognization equipment will do away with the

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[62] Ibid., p. 16.

[63] Enoch Haga, ". . . Introductory Automation and Data Processing for All High School Students," Business Education Forum, XXII (May, 1968), 16-18.

[64] James D. Corcoran, "Makers Say OCR Forms Standard Too Rigid," Office Equipment and Methods (February, 1969), p. 51.

keypunching operation is probably a false one. There will still be the thousands of small installations which will find it more economical to use keypunch rather than more expensive high-speed optical readers. Business educators must be aware of the trends in business and industry, but as vocationalists they must teach today what business needs today.

III. DATA PROCESSING IN ALBERTA HIGH SCHOOLS

Business education is apparently the most popular program in high school among the girls. Generally, more girls than boys enroll in a business education program. A study conducted by Coulson[65] in April, 1969, of grade eleven business education students in the nine composite high schools in the Edmonton Public School Board System, revealed that there were 99 boys and 532 girls enrolled in business education programs during the school year. The study also revealed that the students generally regarded the business education program more than any other program as best for girls and as leading to the best jobs for females, whereas it was generally regarded that the business education program, more than any other program except the general program, was the poorest for boys and led to the poorest jobs for males.[66]

Since the jobs for business education graduates are usually associated with clerical or sales occupations, business education cannot attract the male students who would like to prepare for a professional

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[65]Robert Joseph Coulson, "Educational and Occupational Aspiration of Grade Eleven Business Education Students in Edmonton, Alberta" (Unpublished Master's thesis, University of Alberta, 1969), p. 46.

[66]Ibid., pp. 116-118.

or semi-professional job. Similarly, the girls also aspire toward professional or semi-professional jobs; however, the majority of girls expect to work at the clerical or sales level.

Through proper counseling and guidance, data processing may attract more male students in the business education program. According to a Department of Education Report,[67] in Alberta, data processing is more popular among the girls than the boys. Also, during the 1967-1968 school year, of the total 900 students enrolled in Data Processing 22, 626 were girls and 274 were boys; that is 70 percent and 30 percent, respectively. Similarly, the enrollment for Data Processing 32 for the 1967-1968 year was 73 percent girls and 27 percent boys. This indicates that data processing is not very popular among the boys.

Data processing is the newcomer in the field of business education in Alberta. In 1965, for the first time, data processing was offered in Alberta in one high school, and only ten students were enrolled in this program. Over the period of five years following its introduction, the enrollment in data processing courses has amounted to over 1,700 students. In Alberta, there were 625 students in data processing in 1966; 1,145 in 1967; 1,209 in 1968; and 1,717 in 1969. The number of schools offering the data processing program in the Province during 1969-1970 school year was 30. This is a marked increase from one school in 1965.

At present, two full-year courses are offered in Alberta; the first, at grade eleven level, called Data Processing 22, and the second

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[67] Department of Education, Province of Alberta, Annual Reports for 1965, 1966, 1967, and 1968. See Table XIa, Enrollment in Vocational Subjects in High School Grades, of the Annual Reports of the Department. Note: Other statistics for 1968-1969 and 1969-70 were obtained through personal interview and correspondence with the Inspector of High Schools, Business Education, for the province of Alberta.

at grade twelve level called Data Processing 32. A majority of the students are enrolled in a one-year course, Data Processing 22. Of the 1,717 enrolled in data processing, 1,371 were in Data Processing 22 and only 346 in Data Processing 32. Most high schools in Alberta offer only one year of data processing. In 1968, 27 schools in the Province were offering the grade eleven course and only 11 were offering the grade twelve level course.

It is interesting to note that most schools which offer data processing programs are located in the cities. Data processing does not appear to be offered in rural schools. In 1968, in the Province of Alberta, 27 schools (of which 21 were in the cities) taught data processing. In the same year all 11 of the schools offering the second year course, Data Processing 32, were city schools; no rural schools offered the course. This may be a result of the lack of qualified teacher, of financial difficulties in the rural districts, lack of student placement opportunity, or other undetermined reasons.

CHAPTER III

METHOD OF SOLUTION OF THE PROBLEM

Several different methods of research were used throughout the study. It was felt that no one single method could do justice to the investigation. The method of investigation should depend upon the problem. The researcher felt that more than one technique would be both acceptable and desirable in this type of research.

The study is not designed to test any specific hypotheses. However, it should be possible to suggest some specific hypotheses on the basis of the conclusions of the study.

Because of the small size of the population, sampling was deemed unnecessary.

The study is primarily descriptive in nature. This method was used because of the nature of the study. The study is a survey of the beginning data processing personnel in the Edmonton area with a view to suggesting changes in the business education curriculum for the province of Alberta.

Even though the primary nature of investigation is descriptive, various supplementary techniques were also used in the study. The supplementary techniques which were used were: library research, personal interview, statistical, and documentary analysis.

I. JUSTIFICATION OF THE METHOD

The data for the study were collected through written questionnaires. Questionnaires are often the only practical devices available

to secure data and if carefully constructed and properly checked prior to being used, they serve the researcher well.[1] In a city the size of Edmonton, with a population of about 400,000, it would be impractical to attempt a survey which depended upon a personal interview technique exclusively. In this study, both the personal interview and the written questionnaire techniques were used.

A questionnaire can be constructed which is short and which can be answered in a reasonably short period of time. Furthermore, the questionnaire can provide a great deal of information by providing means by which many questions can be answered easily and quickly. The questions can be constructed so that the answers given are generally accurate and truthful.

The information obtained can be classified to provide a large body of valuable and fairly reliable information which eventually should aid in the curriculum development in business education. An important outcome of this type of survey is that it brings together businessmen and educators. This will result in a better understanding between the two and consequently provides a meaningful relationship between the workers in business offices and the learning situation of the students in the business education courses. A survey of this type provides the businessmen with an opportunity to take a real and active part in improvement of business education.

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[1]S. A. Romine, "Criteria for a Better Questionnaire," Journal of Educational Research, XLII (september, 1948), 69-71

II. HOW DATA WERE OBTAINED AND TREATED

In order to collect the data, a two-part tentative questionnaire was designed. Part A (Exhibit A) was to be answered by data processing supervisory personnel. For easier identification, part A was spirit duplicated on colored paper. Part B (Exhibit B) was to be answered by all employees who had less than two years of experience in data processing. This part was duplicated on white paper. The questionnaire was discussed with the chairman of the Business Education and Office Administration Department of the University of Montana.

The tentative questionnaire was discussed with a vice-president of a computer utility company in Missoula, Montana, who offered many helpful suggestions. Part B of the questionnaire was administered to three employees of the computer utility company to determine if it furnished the data for which it was designed. The questionnaire was also discussed with the President of the Data Processing Management Association, Edmonton Chapter, who offered many additional suggestions for its improvement. Another trial run of Part B was made in Edmonton to four beginning data processing workers. The questionnaire was discussed with business education teachers in Edmonton to obtain their remarks and suggestions. The final draft of the questionnaire was mailed to the chairman of the Business Education and Office Administration Department at the University of Montana for his approval.

At the Education Night meeting of the Edmonton Chapter of the Data Processing Management Association, the writer explained to the members the nature and the purpose of the proposed study. DPMA members agreed to cooperate in the study by filling out the questionnaires when received.

A list of all the data processing installations in Edmonton was obtained through DPMA, the Computer Society of Canada, and the representatives of the computer manufacturers. Where it was possible, the name of the supervisor of the data processing department was also obtained. Telephone contacts were made with the supervisors in order to determine the number of beginning data processing employees in each participating firm so that enough copies of Part B of the questionnaire could be mailed.

The final draft of the questionnaire was duplicated on an offset machine. For easier identification, Part A was duplicated on colored paper and Part B on white paper.

Part A was designed to furnish the information to determine the type of participating firm, the size of the firm, office, and data processing department, and the number of employees with less than two years' experience in data processing. It was also designed for the number of positions in each job classification and future employment opportunities. The last three sections of Part A of the questionnaire were to determine the equipment used, information about the respondent, and remarks.

Part B of the questionnaire was to be answered by all employees who had less than two years' experience in data processing. This part was designed for the collection of data of jobs performed, experience, education, training, and remarks of beginning data processing personnel. Space was provided on the questionnaire for comments.

A covering letter (Exhibit C) and a self-addressed, stamped envelope were enclosed with each group of questionnaires. The covering letter explained the purpose of the study. It was a form letter, duplicated on an offset duplicator. The inside addresses and salutations

were typed with a machine using a carbon ribbon, thus providing a letter which appeared to be personally typed. The data processing supervisors of five firms were interviewed personally in order to explain the nature and the purpose of the study. The comments of the people interviewed were found to be very helpful, especially in their opinions and suggestions regarding business education. At four business offices the questionnaires were delivered and picked up personally.

Questionnaires were sent to 25 data processing installations. The total number of business firms participating in the study was 22; three firms had two separate departments of data processing. Some business firms were contacted by telephone for the return of the questionnaires. Three participating firms contacted the researcher in order to clarify some questions asked on the questionnaire. Part A of the questionnaire was returned by all of the firms contacted.

The business firms contacted in this survey reported that they employed 180 beginning data processing employees. Sufficient copies of Part B were mailed to the participating firms. Extra copies were enclosed to allow for the possibility of spoilage and for the reference of the participating firm. The number of Part B completed questionnaires returned was 156, or 86.7 percent. Some employees were contacted by telephone in order to clarify some of the responses. Only one firm objected to supplying the names of the beginning data processing personnel. The firm also wished that a summary of the study be sent to the supervisory personnel only and not to the individual employees.

In order to do the statistical analysis of the data, the facilities of the computing center of the Edmonton Public School Board were used. The mark-sense sheets designed to check multiple choice type

tests were used. The writer encountered some difficulty as the questionnaire was not originally designed for statistical analysis with this kind of instrument. The responses from the questionnaires were coded on the mark-sense sheets. Certain responses required more than one answer space on the mark-sense sheet. Data for such responses were compiled manually from the computer print out.

The coded mark-sense sheets were checked visually against the questionnaires in order to insure accuracy. Certain items were not suitable for analysis by using the mark-sense sheet, and the statistical tabulation of these items was made manually.

CHAPTER IV

ANALYSIS OF THE DATA

The discussion in this chapter revolves about the questions raised in the statement of the problem in Chapter I. The questions discussed are: Who are the major employers of beginning data processing personnel? Who are the beginning data processing personnel? What types of jobs are assigned to these workers? What education, training, and experience do the beginning data processing personnel have?

I. PARTICIPATING FIRMS

As will be recalled from the discussion in the third chapter of this study, a two-part questionnaire was designed in order to collect data. Part A was to be answered by supervisory personnel of the data processing department. This part was designed to collect data about the participating firms.

The 25 business establishments which took part in this study were divided into five different classifications. The five classifications are as follows:

1. Government and Public Services
2. Wholesaling
3. Manufacturing
4. Services
5. Transportation and Construction

An explanation of the types of firms which constitute each classification is given below:

Government and Public Services. This group is composed of various departments at all three levels of government: federal, provincial, and local. There were two departments of Alberta Government Telephones in this group. Other firms in this group were: Alberta Liquor Control Board, City of Edmonton, Alberta Treasury Branch, Unemployment Insurance Commission, and the University of Alberta. One utility company (natural gas) was also included in this group.

Wholesaling. Included in this group of firms were two departments of a petroleum marketing firm, two food companies, and one hardware firm.

Manufacturing. This group of business establishments included two garment manufacturing companies, one cement and building material company.

Services. Two computer utility companies were included in this classification. There was one auto club and one medical insurance company in this group.

Transportation and Construction. This group is composed of two departments of the Canadian National Railways, one construction company, and one construction equipment dealer.

Table I shows the number of firms in each classification. There were eight government and public service establishments. This group made up 32 percent of the participating firms; the greatest number of establishments in this study. There were five wholesaling firms, comprising 20 percent. Manufacturing, services, and transportation and construction had four participating firms each.

TABLE I

TYPES OF BUSINESS FIRMS REPORTING IN THE STUDY

Types of Business	Number	Percent
Government and Public Services	8	32
Wholesaling	5	20
Manufacturing	4	16
Services	4	16
Transportation and Construction	4	16
TOTAL	25	100

The participating firms were divided into three classifications according to the total number of workers in the establishment. The firms with one to 100 employees were classified small; 101 to 500 as medium; and over 500 as large. Table II shows, of the 25 participating firms, six were small, eight medium and eleven large.

In the government and public services group, out of eight firms one-half were large, three medium, and one small. The wholesaling group had two small, one medium and two large firms. In the manufacturing classification one firm was small, two medium, and one large. Services did not report any large firm, but had two small and two medium-sized firms. All four firms in the transportation and construction category were large.

For convenience in classifying offices according to the size, the following method of classification was used:

TABLE II

NUMBER AND SIZE OF FIRMS IN EACH CLASSIFICATION

Type of Firm	Total	Size of the Firm		
		Small (1-100)	Medium (101-500)	Large (over 500)
Government and Public Services	8	1	3	4
Wholesaling	5	2	1	2
Manufacturing	4	1	2	1
Services	4	2	2	0
Transportation and Construction	4	0	0	4
TOTAL	25	6	8	11

Offices with one to 25 office workers were considered small.

Offices with 25 to 50 office workers were considered medium.

Offices with over 50 office workers were considered large.

Table III shows that 17, or over two-thirds of the offices were large, two were medium, and six were small. In government and public services, and transportation and construction, the large offices predominated. Of the eight offices in government and public services, seven were large, and one was small. All four offices in transportation and construction were large. Wholesaling, manufacturing, and services had two large offices each. Only wholesaling and manufacturing reported one medium office each. Government and public services, and manufacturing had one small office each. Wholesaling and services reported two small offices each.

TABLE III

NUMBER AND SIZE OF OFFICES IN EACH CLASSIFICATION

Type of Firm	Total	Size of the Office		
		Small (1-25)	Medium (25-50)	Large (over 50)
Government and Public Services	8	1	0	7
Wholesaling	5	2	1	2
Manufacturing	4	1	1	2
Services	4	2	0	2
Transportation and Construction	4	0	0	4
TOTAL	25	6	2	17

The data processing installations were classified according to size. The following method of classification was used: (See Table IV)

Data processing installations with one to 15 employees were considered small.

Data processing installations with 16 to 30 employees were considered medium.

Date processing installations with over 30 employees were considered large.

There was no definite relationship between the size of offices and the size of data processing installations. In government and public services there were seven large offices, but there were only four large data processing installations. On the other hand, transportation and construction had all four offices classified as large, but only one data processing installation was classified as large.

TABLE IV

NUMBER AND SIZE OF DATA PROCESSING INSTALLATIONS IN EACH CLASSIFICATION

Type of Firm	Total	Size of the Data Processing Installation		
		Small (1-15)	Medium (16-30)	Large (over 30)
Government and Public Services	8	3	1	4
Wholesaling	5	3	0	2
Manufacturing	4	3	0	1
Services	4	2	1	1
Transportation and Construction	4	1	2	1
TOTAL	25	12	4	9

This study is concerned primarily with the beginning data processing personnel, data processing installations, and data processing workers. For these reasons, the size of the data processing installation will be mentioned in the future tables and discussion rather than the size of the firm or the office.

Table IV shows that small data processing installations predominated in this study. Of the 25 installations, 12, almost one-half were classified as small. There were nine large and four medium-sized data processing installations. Government and public services had three small, one medium, and four large installations. This group had the greatest number of large installations. Wholesaling reported three small and two large installations. The manufacturing group had three small and one large installation. In the services group there were two

small, one medium, and one large installation. There were one small, two medium, and one large installation in the transportation and construction group.

Jobs Performed by All the Data Processing Personnel

This section of the study contains information about all the data processing personnel of the firms which participated in this survey. The data were collected to determine the total number of data processing employees in various job classifications and to determine the ratio of the beginning workers to the total workers. The data processing supervisors were asked if the present job would continue in the next three years. Data were also collected to determine the additional employees required during the next year.

As indicated by the figures appearing in Table V, the largest number of employees who were working full time were keypunch and verifier operators. This group had 190 employees. The next largest group was computer programers, with 48, followed by 31 supervisors of data processing, 29 computer operators, 29 tabulation machine operators, 27 consol operators, and 24 analysts. There were 17 train clerks (machine operators), 15 data control clerks, 14 sorting machine operators, 10 tape handlers, 9 validation clerks, and 5 coding clerks.

Classifications of head keypunch and verifier operators, tub girls (card pickers), and control unit operators each had three full time employees. There were two full time employees in each one of the following categories: assistant consol operator, data center manager, reproducer operator, interpreter operator, application analyst, high speed printer operator, card tape converter and burster operator. The

TABLE V

TIME SPENT BY ALL DATA PROCESSING EMPLOYEES AND ADDITIONAL EMPLOYEES REQUIRED DURING THE NEXT YEAR, BY JOB CLASSIFICATION

Job Classification	Full Time	Half Time	Quarter Time	Occasionally	Additional Employees Required Next Year
Keypunch and Verifier Operator	190	46	1	6	18
Computer Programmer	48	1	0	3	16
Supervisor, Data Processing	31	0	1	0	0
Computer Operator	29	0	0	1	6
Tabulation Machine Operator	29	0	0	0	1
Consol Operator	27	1	0	1	9
Analyst	24	0	1	0	1
Train Clerk, Machine Operator	17	1	0	0	2
Data Control Clerk	20	3	3	0	0
Sorting Machine Operator	14	0	0	2	0
Tape Handler	10	0	0	0	0
Validation Clerk	9	0	0	0	2
Coding Clerk	5	0	0	1	11
Head Keypunch and Verifier Operator	3	0	0	0	0
Tub Girl - Card Puller	3	0	0	0	0
Control Unit Operator	3	0	0	0	0
Card-Tape-Converter	2	0	0	1	0
Assistant Consol Operator	2	0	0	2	0
Data Center Manager	2	0	0	0	0
Reproducer Operator	2	0	0	0	0
Interpreter Operator	2	0	0	0	0
Application Analyst	2	0	0	0	0
Burster Operator	2	0	0	0	0
High Speed Printer Operator	2	0	0	0	0
Data Typist	1	0	0	0	0
Punch Card Machine Technician	1	0	0	0	0
Tape Librarian	1	0	0	0	0
Chief Operator	1	0	0	0	0
Planning Supervisor	1	0	0	0	0

following classifications reported one full-time employee each: data typist, punched card machine technician, tape librarian, chief operator, and planning supervisor.

Forty-nine employees, the largest number, worked half time as keypunch and verifier operators. The next greatest number, three, spent half of their time as coding clerks. Categories of computer programmer, consol operator, and train clerk each had one half-time employee.

Very few employees spent only a quarter of their time on any activity. The employees who spent only one-quarter of their time in various classifications were three coding clerks, one keypunch and verifier operator, one data processing supervisor, and one analyst.

There were six employees who worked occasionally as keypunch and verifier operators, three as computer programmers, two as sorting machine operators, and two assistant consol operators. In each of the following categories there was one employee who worked occasionally: computer operator, consol operator, coding clerk, and card tape converter.

It was noted that most of the employees performed only one full-time activity. This was especially true in large installations. In small installations the employees were required to perform more than one job.

Additional Employees Required

In order to analyze the future demand in data processing the supervisory personnel were asked to indicate the approximate number of additional employees required during the next year. Upon examination of figures in Table V, it may be noted that there were 48 full-time

computer programmers, and the estimated demand for the next year was 16 additional programmers. This was an expected increase of 33 percent from the previous year. It is in agreement with the research cited in Chapter II.

It was noted that the anticipated requirements were for 18 additional keypunch and verifier operators, 11 coding clerks, and 9 consol operators. The expected requirements for coding clerks and train clerks were two for each job classification. Only one employee was expected to be required for each classification of tabulation machine operator and analyst.

It was observed that most of the expected additional requirements were reported by the large data processing installations. It was also noted that the employees in small installations were required to perform various jobs during the day, whereas employees in large installations worked full time on one job.

In Table VI, it will be noted that all respondents did not answer whether the present job will exist from one to three years from now. This is possibly because all the participating installations did not have employees in all job classifications. Some respondents noted that it was difficult to predict as the future jobs will depend upon the type of equipment their companies will install.

The following numbers of respondents reported an expectation that the corresponding present jobs would continue to exist from one to three years from now: supervisor data processing, 18; keypunch and verifier operator, 15; computer programmer, 12; computer operator, 11; consol operator, 10; validation clerk, 7; and analyst, 5. It was reported by three firms that job classifications of head keypunch and verifier

TABLE VI

THE OPINION OF THE SUPERVISORS AS TO WHETHER THE PRESENT JOB WILL EXIST ONE TO THREE YEARS FROM NOW

Job Classification	Number Reporting Job Will Exist
Supervisor of Data Processing	18
Keypunch and Verifier Operator	15
Computer Programmer	12
Computer Operator	11
Consol Operator	10
Validation Clerk	7
Analyst	5
Head Keypunch and Verifier Operator	3
Data Control Clerk	3
Sorting Machine Operator	2
Tabulating Machine Operator	2
Coding Clerk	2
Burster Operator	2
Data Center Manager	2
Reproducing Punch Operator	2
Alphabetic Punch Operator	2
Card Tape Converter Operator	1
Tape Handler	1
High Speed Printer Operator	1

operator and data control clerk will continue to exist in the near future.

For each of the following classifications two respondents noted that the job will exist from one to three years from now: sorting machine operator, tabulating machine operator, coding clerk, burster operator, data center manager, reproducing punch operator, and alphabetic punch operator. The job classifications of card tape converter operator, tape handler, and high speed printer operator were reported once only.

Equipment Used by the Participating Firms

Table VII shows that there were more keypunch machines than any other equipment. There were 138 keypunch machines. The table also shows that keypunch machines were used by 24 firms. The second largest number, 85, were verifiers. There were 63 tape units, a substantial number. About half of the firms reported using the tape units. Sorters were used by almost all of the firms; there were 38 pieces of this equipment reported in use. The use of computers was reported by 18 business firms and there were 23 computers used. The use of disc units was reported by 15 firms, and 10 firms reported having collators. The other types of equipment were reported in use, but not in substantial numbers. In most cases the firms reporting the use of such equipment had only one piece in use.

TABLE VII

TYPE OF EQUIPMENT USED BY THE PARTICIPATING FIRMS

Type of Equipment	No. of Pieces Used	No. of Firms Using
Keypunch	138	24
Verifier	85	18
Tape Unit	63	12
Sorter	38	22
Computer	23	18
Disc Unit	22	15
Collator	12	10
Interpreter	8	7
Reproducer	7	6
Transmitters	6	1
Tabulator	5	5
Optical Scanner	2	2
Card Processor	2	2
Paper Tape Converter	2	2
Burster	2	2
Selectronic Form Detacher	1	1
Carbon Separator	1	1
Cheque Signer	1	1
Decalator	1	1

II. THE BEGINNING DATA PROCESSING PERSONNEL

Employers of Beginning Data Processing Personnel

This part of the study deals primarily with the beginning data processing personnel. One aspect of the study was to determine the major employers of the beginning workers. As can be learned from the figures presented in Table VIII, the major employers of the beginning data processing employees were government and public services firms. This table shows that out of 156 beginning employees, 67 were in government and public services, the largest single group. This is 43.0 percent of the population of this study. The next greatest number was 41, 26.2 percent, employees in wholesaling; followed by 23, 14.7 percent, in manufacturing; 13, 8.4 percent, in transportation and construction; and 12, 7.7 percent, in services. Government and public services and wholesaling accounted for two-thirds of the new employees. It is interesting to note that government and public services accounted for 32 percent of the participating firms (see Table I, page 52), and 43 percent of the beginning personnel. Wholesaling firms participating in the study accounted for 20 percent of all the firms while employing 26.2 percent of all the beginning workers. The reason that the government and public services and wholesaling accounted for a higher percentage of beginning employees in comparison to the ratio of the participating firms in these categories is that there were more large data processing installations in these classifications (see Table IV, page 55). Six out of nine large installations were in government and public services and wholesaling.

On the other hand, services, manufacturing, and transportation and construction each constituted 16 percent of the participating firms.

TABLE VIII

BEGINNING DATA PROCESSING EMPLOYEES REPORTING IN EACH TYPE OF BUSINESS CLASSIFICATION

Type of Business	Number	Percent
Government and Public Services	67	40.0
Wholesaling	41	26.2
Manufacturing	23	14.7
Transportation and Construction	13	8.4
Services	12	7.7
TOTAL	156	100.0

The participating rate of the beginning employees was 7.7 percent for services, 14.7 percent for manufacturing, and 8.4 percent for transportation and construction. This may be due to the fact that out of the 12 participating firms in services, transportation and construction, and manufacturing only three were classified as large data processing installations.

It appears from the above discussion that most of the beginning data processing personnel are found in large data processing installations. Also, it seems that most of the large data processing installations are in two segments of the economy; namely, government and public services and wholesaling.

Age and Sex

One portion of the study was designed to learn who the beginning data processing personnel are. It was noted in Table IX, that the

TABLE IX

BEGINNING DATA PROCESSING PERSONNEL
BY AGE AND SEX

Classification	Number	Percent
Age		
Under 20	46	29.5
21 - 30	94	60.3
31 - 40	14	9.0
Over 40	2	1.3
Total	156	100.1
Sex		
Male	70	44.9
Female	86	55.1
Total	156	100.0

majority of the beginning data processing personnel were between the ages of 21 and 30. Since no exact ages of the subjects were asked, no mean age of the group is available.

Of the total 156 subjects in the study, 94, or 60.3 percent, were between the ages of 21 and 30. Forty-six employees, 29.5 percent, reported being under 20 years of age. There were 14 employees between the ages of 31 and 40, 9 percent of the population. Only two beginning employees were over 40 years of age.

If a narrower subdivision of the age groups had been provided, the results might have been more specific. The analysis of the data shows that about 90 percent of the beginning employees were under 30

years of age. It can be reasonably estimated that the majority of the beginning data processing employees are young.

Table IX also shows that there were more female and male employees. The majority of the female employees, though not overwhelming, was noticeable. Of the 156 beginning workers, 86 were females and 70 males, which is 55.1 percent and 44.9 percent, respectively. The majority of the female workers may be due to the fact that 70 beginning employees, 44.9 percent, Table X, were keypunch and verifier operators. These jobs are usually held by the female employees.

Job Classifications

The chief purpose of this survey was to determine the entry jobs available in data processing installations. The subjects were asked to give the job titles of their present positions. Table X illustrates the distribution of various job classifications of beginning workers. It was noted that almost one-half of the workers were keypunch and verifier operators. Of the total of 156 beginning workers in this study, 70 were keypunch and verifier operators. The two job classifications of keypunch and verifier operators were combined after considering the nature of their jobs. Both jobs are almost identical, and in certain firms no distinction is made in classifying these two categories.

The next largest number, 21, were computer programmers, followed by 15 computer operators, and 11 tabulation machine operators. There were eight analysts and five supervisors of data processing. Categories of tub girls, high speed printer operators, and bursters had two beginning employees each. Both consol operator and interpreter operator had one beginning employee each.

TABLE X

BEGINNING DATA PROCESSING PERSONNEL
BY JOB CLASSIFICATION

Job Classification	Number	Percent
Keypunch and Verifier Operator	70	44.9
Computer Programmer	21	13.5
Data Control Clerk	17	11.0
Computer Operator	15	9.6
Tabulation Machine Operator	12	7.6
Analyst	8	5.2
Supervisor Data Processing	5	3.2
High Speed Printer Operator	2	1.3
Burster Operator	2	1.3
Tub Girl - Card Puller	2	1.2
Consol Operator	1	.6
Interpreter Operator	1	.6
TOTALS	156	100.0

It should be remembered that the above analysis is only of the job titles and not the actual time spent by the employees on various activities. It was mentioned earlier in this chapter that the employees in small installations are expected to perform various activities related to their jobs.

A comparison of the beginning data processing workers and the total data processing employees of the participating firms is shown in

Table XI. To facilitate comparison, only the job classifications of the beginning data processing personnel are listed. The table shows that in both the categories of high speed printer operator and burster operator, 100 percent of the employees were the beginning workers. The figure may be misleading as there were only two employees in each of the two categories. Since both the machines require simple manipulative skills, training can easily be obtained on the job. It is likely that in most cases these positions are used as entry level jobs. It is possible that the employees hired for these positions are promoted to more demanding positions after they have been with the firm for some time.

Another classification in which most of the employees (17 out of 20) were beginning workers was that of data control clerk. This job does not require any specific training and experience, and it may easily be filled by the beginning office workers. The case may be similar for the interpreter operator, where one out of two was a beginning employee. Two-thirds of the card pullers, two of the three reported, were beginning workers. A little over one-half, 15 out of 29, computer operators were beginning workers.

In other classifications, the beginning employees comprised the following percentages of the total workers: computer programmers, 43.8 percent; tabulation machine operators, 41.4 percent; keypunch and verifier operators, 36.8 percent; analysts, 33.3 percent; data processing supervisors, 16.1 percent; and consol operators, 3.4 percent of the total workers.

It seems from the analysis that the jobs which do not require a high degree of training and experience are usually held by the beginning workers. On the other hand, the jobs which require extensive training

TABLE XI

A COMPARISON OF BEGINNING DATA PROCESSING AND TOTAL DATA PROCESSING WORKERS, BY JOB CLASSIFICATION

Job Classification	Total Workers	Beginning Workers	Percent
Keypunch and Verifier Operator	190	70	36.8
Computer Programmer	48	21	43.8
Data Control Clerk	20	17	85.0
Computer Operator	29	15	51.7
Tabulation Machine Operator	29	12	41.4
Analyst	24	8	33.3
Supervisor Data Processing	31	5	16.1
High Speed Printer Operator	2	2	100.0
Burster Operator	2	2	100.0
Tub Girl - Card Puller	3	2	66.7
Consol Operator	27	1	3.4
Interpreter Operator	2	1	50.0

and experience, such as consol operator, are not readily available to the beginning workers. Of the total 27 consol operators only one was a beginning worker. Positions as keypunch and verifier operators and computer programmers, for which training in educational institutions is given, are held by a considerable porportion of the beginning data processing personnel.

Experience in Data Processing

Those defined as beginning data processing personnel were employees with two years or less experience. The limit was established so that a large enough sample of beginning workers could be obtained. It was believed that the result of a survey of all the data processing personnel may not be conclusive.

The beginning employees were asked to list the extent of their experience. The following four categories were given:

1. Fewer than six months
2. Six months to one year
3. One year to one and a half years
4. One and a half years to two years

Table XII indicates that the distribution of experience over four categories is fairly even. Thirty-six, or 23.1 percent of the employees, had under six months of experience in data processing. Thirty-nine employees, 25.0 percent, had experience from six months to one year. Those who had from one year to one and one-half years of experience comprised the largest group, numbering 47, or 30.1 percent. The employees who had experience of from one and one-half years to two years numbered 34, or 21.8 percent of the beginning data processing employees.

It seems from the above discussion that every six months between 30 to 40 new employees enter the data processing departments of the firms which participated in the survey. However, no other conclusion should be made from these figures, as there were many other data processing firms which were not included in this study.

TABLE XII

DATA PROCESSING EXPERIENCE REPORTED BY THE BEGINNING DATA PROCESSING PERSONNEL

Experience	Number	Percent
Less than six months	36	23.1
Six months to one year	39	25.0
One year to one and one-half years	47	30.1
One year and one-half to two years	34	21.8
TOTAL	156	100.0

Best Source for Employment

An attempt was made to determine the best source of assistance in obtaining the present position. Table XIII shows that a large number of the employees were transferred within the company. Thirty-five out of a total of 156, or 22.4 percent, were transferred within the company to achieve their present positions.

Combining the figures of transfer within the company (35) and promotion within the company (24), a total of 59 employees, or 39.1 percent, were working with the present company before starting on the present job.

About one-fifth of the respondents reported that they just "walked in" and acquired a job with the present employer. This group included 31 out of 156, or 19.9 percent. Referral by a friend or some other person also played an important role in securing the present position.

TABLE XIII

BEST SOURCE OF ASSISTANCE TO THE BEGINNING DATA PROCESSING PERSONNEL IN OBTAINING THE PRESENT POSITION

Source	Number	Percent
Transfer within the company	35	22.4
Walked in	31	19.9
Referral by a friend or some other person	26	16.7
Promotion within the company	24	15.4
Canada Manpower Center	16	10.3
School	8	5.1
Newspaper	4	2.5
Other	12	7.7
TOTAL	156	100.0

Twenty-six employees obtained their present jobs through referral by someone else. This group comprised 16.7 percent of the population. Twenty-four employees, 15.4 percent of the sample, were promoted to the present position. These employees were promoted within the data processing department of the firm in which they were currently working. Sixteen persons obtained the present position through Canada Manpower Center; eight through school; four through newspaper advertisements; and twelve through other sources.

These findings are in agreement with the research cited in Chapter II. Most companies give an opportunity to their own employees who

can qualify to fill new openings in data processing departments. This may be particularly true for the positions where training on the job is easily accomplished. Another reason for transfer within the company may be that the employees are familiar with procedures followed by the firm. Data processing is still an attractive and glamorous field; transfer to this department may be one of the ways of rewarding the employees.

An attempt was made to identify the relationship of job titles and actual jobs performed by the beginning employees. The results were interesting. The employees listed 12 job titles (see Table X, page 66). Table XIV lists 19 job classifications on which the employees spent their time. The division of employees' time was made as follows:

Full time

Five to six hours daily

Three to four hours daily

One to two hours daily

In the job titles 70 employees were listed as keypunch and verifier operators, whereas 72 employees were full time keypunch and verifier operators. The number of employees who worked five to six hours daily as keypunch operators was six; five worked three to four hours, and two one to two hours. Nineteen of the 21 computer programmers worked full time and one reported three to four hours daily. All of the 17 data control clerks were engaged full time in this activity. Of the 15 computer operators 11 worked full time at this job. One reported spending five to six hours; three reported three to four hours; and three one to two hours as computer operators. All the eight analysts spent full time on this activity. There were no part time analysts. Five supervisors

TABLE XIV*

DAILY TIME SPENT ON VARIOUS ACTIVITIES BY THE BEGINNING DATA PROCESSING PERSONNEL

Job Classification	Full Time		5-6 hrs.		3-4 hrs.		1-2 hrs.	
	No.	N%	No.	N%	No.	N%	No.	N%
Keypunch and Verifier Operator	72	46.1	6	3.8	5	3.2	2	1.3
Computer Programmer	19	12.2	0	0.0	1	0.6	0	0.0
Data Control Clerk	17	10.9	0	0.0	0	0.0	1	0.6
Computer Operator	11	7.1	1	0.6	3	1.9	3	1.9
Analyst	8	5.1	0	0.0	0	0.0	0	0.0
Supervisor Data Processing	5	3.2	0	0.0	0	0.0	0	0.0
Consol Operator	2	1.3	1	0.6	0	0.0	4	2.6
Tabulation Machines Operator	7	4.5	1	0.6	7	4.5	3	1.9
Burster Operator	0	0.0	1	0.6	1	0.0	0	0.0
Tub Girl - Card Puller	1	0.6	1	0.6	0	0.0	0	0.0
Optical Scanner Operator	0	0.0	1	0.6	0	0.0	0	0.0
Assistant Consol Operator	0	0.0	0	0.0	1	0.6	1	0.6
High Speed Printer Operator	0	0.0	0	0.0	1	0.6	0	0.0
Punched Card Machine Technician	0	0.0	0	0.0	1	0.6	0	0.0
Card-Tape-Converter Operator	0	0.0	0	0.0	0	0.0	2	1.3
Tape Handler	0	0.0	0	0.0	0	0.0	5	3.2

*Note: This table should be read as follows: Of the 156 beginning data processing personnel 72 were working full time as keypunch and verifier operators, which is 46.1 percent of the group. Six employees (3.8 percent) were working as keypunch and verifier operators from 5-6 hours daily.

of data processing were also engaged full time in this activity. Twelve employees classified as tabulation machine operators. Seven of them were spending all their time on this activity; one, five to six hours; seven, three to four hours; and three, one to two hours daily. Of the total of 156 employees, 142 reported spending full time on one activity.

As mentioned earlier, employees in small data processing installations are usually required to perform more than one activity, while workers in larger installations normally devote full time to only one activity.

Occupation or Activity Prior to Starting at the Present Job

An effort was made to determine the occupation or activity of the subjects prior to obtaining the present job. Table XV shows that 60 employees were in educational institutions, 40 in other office jobs, 45 in non-office jobs, and 11 in other activities.

Of the employees who were in educational institutions, 39 were in high school, 10 in university, 7 in technical institutes, and 4 in other educational institutes. Forty employees were engaged in office jobs before starting at the present position. Twenty-four of this 40 (60 percent) were with the present employer; the remaining 40 percent were with some other employer.

Non-office jobs as an activity were reported by 45 employees. This is 28.8 percent of the subjects. A large majority of this group were with the present employer before starting at the present position. The employees in the non-office job category who were with the present employer made up 77.8 percent of the group; 22.2 percent were with some other employer. These groups numbered 35 and 10 employees, respectively.

TABLE XV*

OCCUPATION OR ACTIVITY OF THE BEGINNING DATA PROCESSING PERSONNEL PRIOR TO STARTING AT THE PRESENT JOB

Occupation or Activity	Total	Percent of Total (N%)	Percent within Classification (n%)
Educational Institution			
High School	39	25.0	65.0
University	10	6.4	16.7
Technical Institute	7	4.5	11.7
Other	4	2.6	6.6
Total	60	38.5	100.0
Other Office Job			
With the Present Employer	24	15.4	60.0
With Some Other Employer	16	10.3	40.0
Total	40	25.7	100.0
Non-Office Job			
With the Present Employer	35	22.4	77.8
With Some Other Employer	10	6.4	22.2
Total	45	28.8	100.0
Other	11	7.0	100.0
TOTAL	156	100.0	

*

Note 1: This table should read as follows: Of the 156 beginning data processing personnel reporting in this study, 60 or 38.5 percent were in educational institutions prior to starting at the present job. Of the 60 who were in educational institutions, 39 were in high school. These 39 workers represented 25.0 percent of all the beginning data processing personnel, but 65.0 percent of the 60 workers who were in educational institutions.

Note 2: As illustrated in the preceding note, in all tables throughout this report unless otherwise stated, capital N indicates the total number of beginning data processing personnel in the study. Lower case n denotes the total indicated on the horizontal line under the Total column.

The employees who were not attending an educational institution or working for an employer marked the "other" classification. Eleven subjects marked "other" as their activity. The subjects were asked to specify the activity in which they were engaged. The majority of them reported their previous activity had been housewife. Two persons were engaged in their small private family businesses. In both cases this was a grocery store.

Office Experience

The figures in Table XVI show that almost two-fifths of the respondents did not have any office experience before starting at the present job. The "no experience" was reported by 62 employees, which is 39.8 percent of the population. The group which had less than one year of office experience was 27, or 17.3 percent of all the respondents.

TABLE XVI

OFFICE EXPERIENCE OF BEGINNING DATA PROCESSING WORKERS PRIOR TO THE PRESENT JOB

Experience	Number	Percent
None	62	39.8
Less than one year	27	17.3
One to two years	29	18.6
Three to five years	26	16.7
Six to ten years	1	0.6
Ten years and over	11	7.0
TOTAL	156	100.0

Twenty-nine employees had one to two years of office experience, and 26 had three to five years, which are 18.6 percent and 16.7 percent, respectively. Only one employee had between six and ten years experience. The employees who had over ten years of experience were 11, which is 7.0 percent of all the respondents.

It seems from the discussion of office experience of the beginning data processing personnel that previous office experience is not ranked highly as a prerequisite for employment in data processing installations. This is in agreement with the research cited in Chapter II.

Non-Office Experience

In Table XVII it will be noted that a substantial number of beginning employees had no experience in non-office occupations. The number was 71, which is 45.5 percent of the beginning data processing

TABLE XVII

NON-OFFICE EXPERIENCE OF BEGINNING DATA PROCESSING PERSONNEL PRIOR TO THE PRESENT JOB

Experience	Number	Percent
None	71	45.5
Less than one year	30	19.2
One to two years	24	15.4
Three to five years	23	14.8
Six to ten years	6	3.8
Ten years and over	2	1.3
TOTAL	156	100.0

personnel. The ranges of the non-office experience were: less than one year, 30; one to two years, 24; three to five years, 23; six to ten years, 6; and over ten years, 2.

The respondents were asked to list all their non-office experience. Four spaces were provided for the employees to write their responses, as it was believed that some respondents may have had numerous types of experience. Eighty-five employees reported that they had non-office experience and 71 had no such experience. This is indicated by the figures in Table XVII, above.

Table XVIII shows that 151 responses were marked by 85 respondents who had non-office experience. Labor as experience was reported by 43 respondents, which is 27.6 percent of all the respondents and 50.6 percent of the non-office experience group. The other major groups were: sales clerks, 41; waitress, 11; cashier, 9; salesman, 8; service station, 6; and instructor, 5. Experience as waiter, delivery, nursing, and driver was reported four times in each of the above classifications. Modeling, switchboard operator, and legal experience was listed twice for each of the categories. The experience of hairdresser, dental assistant, florist, shipper, receiver, and mechanic was listed once in each category.

III. EDUCATIONAL BACKGROUND OF THE BEGINNING DATA PROCESSING PERSONNEL

This part of the study deals with the educational background of the beginning data processing personnel. It indicates the educational level achieved, types of program followed, the courses most helpful in

TABLE XVIII*

TYPES OF NON-OFFICE EXPERIENCE OF BEGINNING DATA PROCESSING PERSONNEL

Type of Experience	Total No.	Percent of Total N%	Percent of 85 Respondents n%
Labor	43	27.6	50.6
Clerk, sales etc.	41	26.3	48.3
Waitress	11	7.1	13.0
Cashier	9	5.8	10.6
Salesman	8	5.1	9.4
Service station	6	3.8	7.6
Instructor	5	3.2	5.9
Waiter	4	2.6	4.7
Delivery	4	2.6	4.7
Driver	4	2.6	4.7
Nursing	4	2.6	4.7
Modeling	2	1.3	2.4
Switchboard operator	2	1.3	2.4
Legal	2	1.3	2.4
Hairdresser	1	0.6	1.2
Dental	1	0.6	1.2
Florist	1	0.6	1.2
Shipper	1	0.6	1.2
Receiver	1	0.6	1.2
Mechanic	1	0.6	1.2

*Note 1: The responses are of 85 employees. Some wrote more than one response as they had varied experiences.

Note 2: This table should read as follows: Of the 156 beginning data processing personnel reporting in this study, 85 or 54.5 percent reported non-office experience. Of the 85 who reported non-office experience, 43 reported labor as non-office experience. These 43 workers represented 27.6 percent of all beginning data processing personnel, but 50.6 percent of the 85 who had non-office experience.

the present job, and the courses the employees wished they had taken in order to better prepare them for jobs in data processing. The findings of this part of the study will help in making recommendations for changes in the business education curriculum.

High School Education

Table XIX shows that over three-fourths of the respondents had completed high school. The number of employees who had finished high school was 119 and those who had not completed it was 37; this is 76.3 percent and 23.7 percent, respectively.

It can also be noted that a substantial number of respondents were enrolled in the senior matriculation program. The senior matriculation curriculum was followed by 59 employees which accounted for 37.8 percent of the respondents. The curricula followed by the remaining respondents were: business education, 41; general, 23; combination of business education and senior matriculation, 22; vocational, 3; and other, 8.

The total of the senior matriculation and combination of business and senior matriculation made up 52.5 percent of the subjects. It appears that the university entrance program is popular among the students in high school. At the same time, a large number of employees had taken business education in high school. The total number of employees who had completed the business education curriculum or the combination of business and senior matriculation programs was 40.4 percent of the respondents. However, no other conclusions can be drawn due to the lack of data relating to educational institutions attended by the respondents.

TABLE XIX

HIGH SCHOOL EDUCATION OF BEGINNING DATA PROCESSING PERSONNEL

Classification	Number	Percent
High School Completed		
Completed	119	76.3
Not Completed	37	23.7
TOTAL	156	100.0
High School Curriculum Followed		
Senior Matriculation University Entrance	59	37.8
Business Education	41	26.3
General	23	14.8
Combination of Business and Senior Matriculation	22	14.1
Vocational	3	1.9
Other	8	5.1
TOTAL	156	100.0

Table XX shows the business subjects studied and grade level reached by the beginning data processing personnel. It was noted that typewriting was studied by more respondents than any other subject. Typewriting was taken in high school by 115 respondents; bookkeeping by 37; office practice, 37; shorthand, 33; record-keeping, 33; business fundamentals, 28; business law, 24; data processing, 20; clerical

practice, 19; economics, 19; business management, 13; and merchandising, 11.

Typewriting is taught for three years in Alberta high schools. Forty-two of the 115 respondents who had taken typewriting in high school, 36.5 percent, had taken only one year of typewriting. Forty-one had taken typewriting for two years and 32 for three years.

The majority of the employees who had taken bookkeeping in high school had studied this subject for two years. The figures revealed that 24 had studied up to Grade X level; 28, Grade XI level; and 15, Grade XII level. Business mathematics is taught to Grades X and XI in Alberta high schools. Eleven employees had taken business mathematics for one year; 31 for two years; and 1 for three years. It is likely that the employee who had studied business mathematics for three years had taken his high school education outside of Alberta.

A business machines course in Alberta is normally offered in Grade XII. Almost all the employees, 91.9 percent, had taken this subject in Grade XII. Three employees reported that they had studied business machines in Grade XI only.

Office practice courses in Alberta are not sequential; therefore it is not possible to analyze, from the present data, the number of years the respondents had studied this subject. Of the 37 who had studied office practice, 2 reported Grade X; 20, Grade XI; and 15, Grade XII. Recordkeeping is a terminal course and is usually offered in Grade X. The majority of the respondents, 30 out of 33, had studied it in Grade X, and three reported having taken it in Grade XI. Business fundamentals is another terminal course offered in Grade X. Of the 28 employees who had studied this subject, 27 reported that they took it

TABLE XX*

BUSINESS SUBJECTS STUDIED AND GRADE LEVEL REACHED IN HIGH SCHOOL BY BEGINNING DATA PROCESSING PERSONNEL

Subject Studied	Total		Grade Ten			Grade Eleven			Grade Twelve		
	No.	N%	No.	N%	n%	No.	N%	n%	No.	N%	n%
Typewriting	115	73.7	42	26.9	36.5	41	26.3	35.6	32	20.5	27.8
Bookkeeping	67	42.9	24	15.4	35.8	28	17.9	41.8	15	9.6	22.4
Business Mathematics	43	27.6	11	7.1	25.6	31	19.9	72.1	1	0.6	2.3
Business Machines	37	23.7	0	0.0	0.0	3	1.9	8.1	34	21.8	91.9
Office Practice	37	23.7	2	1.3	5.4	20	12.8	54.0	15	9.6	40.6
Shorthand	33	21.2	15	9.6	45.5	7	4.5	21.2	11	7.1	33.3
Recordkeeping	33	21.2	30	19.2	91.0	3	1.9	9.0	0	0.0	0.0
Business Fundamentals	28	17.9	27	17.3	96.5	0	0.0	0.0	1	0.6	3.5
Business Law	24	15.4	2	1.3	8.3	22	14.1	91.7	0	0.0	0.0
Data Processing	20	12.8	0	0.0	0.0	6	3.8	30.0	14	9.0	70.0
Clerical Practice	19	12.1	1	0.6	5.3	18	11.5	94.7	0	0.0	0.0
Economics	19	12.1	0	0.0	0.0	0	0.0	0.0	19	12.1	100.0
Business Management	13	8.3	2	1.3	15.4	4	2.6	30.8	7	4.5	53.8
Merchandising	11	7.0	1	0.6	9.1	10	6.4	90.9	0	0.0	0.0

*Note: This table should be read as follows: Of the 156 beginning data processing personnel in this study, 67 or 42.9 percent, took bookkeeping in high school. Of the 67 who took bookkeeping, 24 reached Grade Ten level. Those 24 represented 15.4 percent of all 156 employees reporting in this study, and 35.8 percent of all who took bookkeeping.

in Grade X. One employee reported having taken it in Grade XII, which could be due to the fact that he had his education outside the Alberta system. Business law is a one-year course and offered in Grade XI. Of the 24 respondents who had studied business law, 22 reported taking it in Grade XI and two in Grade X.

Data processing ranked eighth among the business subjects studied in high school. It is a new subject added to the business education curriculum in Alberta and was taught for the first time in one school in 1965. At present, data processing is offered in Grades XI and XII in Alberta. Twenty employees reported that they had studied data processing in high school. This is 12.8 percent of the total population of this survey.

The Grade XI course in data processing was taken by six employees, or 3.8 percent of the total beginning data processing personnel, and 30.0 percent of the group who had studied data processing in high school. Fourteen employees reported that they had studied the Grade XII data processing course. This is 9.0 percent of the total subjects and 70.0 percent of those who had taken data processing in high school.

In Alberta, clerical practice is a Grade XI course. Nineteen employees reported having taken this course, 18 in Grade XI and one in Grade X. Economics is offered in Grade XII and in Alberta it is part of social sciences rather than of business education. It was studied by 19 respondents in Grade XII. The number of beginning workers who had studied merchandising in high school was 11. Ten of them reported taking it in Grade XI and one in Grade X.

An attempt was made to determine the course which was considered most helpful by the beginning data processing personnel. The responses

were not restricted to high school programs and business education subjects. The subjects were asked to list the courses which they considered as having been most helpful in relation to their present job. Respondents were also asked to list the courses in order of importance to them.

In Table XXI it will be noted that the greatest number, 66, reported typewriting the most helpful subject. This group comprises 42.3 percent of the population of this study. The second largest number, 49, which constitutes 31.4 percent of the respondents, reported data processing as being most helpful. The other subjects considered helpful by the respondents were: mathematics, 31; bookkeeping, 27; business machines, 25; office practice, 16; English, 12; and shorthand and clerical practice, two each.

The data were further analyzed to determine the rating given to various subjects by the respondents. A six-level rating scale was designed. The subjects which were considered most helpful were listed first, and the subjects which were not rated very highly were listed last.

Of the 66 employees who reported typewriting as one of the most helpful subjects, over one-half, 54.5 percent, ranked it first; 37.8 percent, second; 4.5 percent, third; 1.6 percent, fifth; and 1.6 percent, sixth.

Twenty respondents had studied data processing in high school (see Table XX, page 83). It was reported that 49 employees found data processing the most helpful course in their present positions. It is indicated by these statistics that at least 29 employees had taken training in data processing outside high school. It is interesting to

TABLE XXI*

COURSES THAT WERE FOUND MOST HELPFUL ON THE JOB
TO THE BEGINNING DATA PROCESSING PERSONNEL

Course	Total		RATING																
			First			Second			Third			Fourth			Fifth			Sixth		
	No.	N%	No.	N%	n%	No.	N%	n%	No.	N%	n%	No.	N%	n%	No.	N%	n%	No.	N%	n%
Typewriting	66	42.3	36	23.0	54.5	25	16.0	37.8	3	1.9	4.5	0	0.0	0.0	1	0.6	1.6	1	0.6	1.6
Data Processing	49	31.4	45	27.8	91.8	3	1.9	6.1	1	0.6	2.1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Mathematics	31	19.9	15	9.6	48.4	12	7.7	38.7	2	1.3	6.4	1	0.6	3.2	1	0.6	3.2	0	0.0	0.0
Bookkeeping	27	17.3	6	3.8	22.2	12	7.7	44.4	4	2.6	14.8	3	1.9	11.1	1	0.6	3.7	1	0.6	3.7
Business Machines	25	16.0	8	5.1	32.0	6	3.8	24.0	7	4.5	28.0	3	1.9	12.0	0	0.0	0.0	1	0.6	4.0
Office Practice	16	10.3	2	1.3	12.5	7	4.5	93.7	3	1.9	18.7	1	0.6	6.3	3	1.9	18.7	0	0.0	0.0
English	12	7.7	6	3.8	50.0	5	3.2	41.6	0	0.0	0.0	1	0.6	8.4	0	0.0	0.0	0	0.0	0.0
Shorthand	2	1.3	0	0.0	0.0	1	0.6	50.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	0.6	50.0
Clerical Practice	2	1.3	0	0.0	0.0	0	0.0	0.0	1	0.6	50.0	1	0.6	50.0	0	0.0	0.0	0	0.0	0.0

*Note: Of the 156 beginning personnel only responded to this question. Thirty-seven did not list any courses which they thought helpful on the job.

note that 45 of them, 91.8 percent of this group, ranked it first. Three employees ranked it second and one third.

Almost one-half of the group which listed mathematics as a helpful course ranked it first. Of the 31 in this group, 15 ranked it first; 12, second; 2, third; 1, fourth; and 1, fifth. Bookkeeping was thought to be a helpful subject by 27 employees. It was ranked first by 6 employees; second by 12, and third by 4. Bookkeeping was ranked fourth by 3, fifth by 1, and sixth by 1. The value of the business machines course was spread over a wide range. The greatest number, 8, ranked it first among the most helpful subjects in their position. It was ranked second by 6, third by 7, fourth by 3, and sixth by 1 employees.

The course in office practice was considered helpful by 16 employees. It was not rated very highly. Seven employees rated it second and only two rated it as the most helpful course. It was ranked third and fifth more often than first by employees.

The courses in shorthand and clerical practice were not considered very helpful by the respondents. Only two employees thought each of the two courses helpful in their positions. These courses were not ranked first by any employee.

This part of the questionnaire was not answered by all the respondents. One hundred and nineteen of the 156 subjects responded to this part of the questionnaire. Thirty-seven did not list any course they thought was helpful to them on their present job.

In order to recommend changes in the high school curriculum, the employees were asked to list the courses which they wished they had taken in order to prepare them better for the present job. The responses were not restricted to the high school programs and business education

subjects. Less than one-half of the subjects responded to this part of the questionnaire. Of the total 156 beginning data processing personnel, 73 answered this part, and 83 did not express any opinion. The inability of over one-half of the population to express an opinion could be due to two factors. First, those who did not respond considered their training sufficient for the present job. Second, they may not be aware of the possibilities for improvement in their educational program. It is interesting to note in Table XXII that three-quarters of the group who responded expressed a regret that they had not taken data processing. These people numbered 55 of the 73 respondents who answered the question. Other courses which the respondents felt would have been helpful if they had been taken, and the number stating each were: bookkeeping, 17; typewriting, 9; business machines and business management, 8 each; and computer programming, 6. Office practice and clerical practice were listed three times each and numerical analysis two times. The courses which were listed one time only were computer technology, statistics, and English.

Post High School Education

This part of the discussion is divided into two segments. Part one deals with the training in all post secondary institutions other than universities. The second part deals with the university graduates. The figures in Table XXIII show that 67 employees had training in institutions beyond high school other than university. This represents 43 percent of the beginning data processing personnel. The majority of the group had only a short training in a post secondary institution. Over two-thirds, 46 persons, had training of less than one year. One year of

TABLE XXII*

COURSES THE BEGINNING DATA PROCESSING PERSONNEL WISHED THEY HAD TAKEN IN ORDER TO PREPARE THEM BETTER FOR THE PRESENT JOB

Course	Total	Percent of Total (N%)	Percent Within Classification (n%)
Data Processing	55	35.2	75.4
Bookkeeping	17	10.9	23.2
Typewriting	9	5.8	12.3
Business Machines	8	5.1	11.0
Business Management	8	5.1	11.0
Mathematics	7	4.5	9.6
Programming	6	3.8	8.2
Office Practice	3	1.9	4.1
Clerical Practice	3	1.9	4.1
Numerical Analysis	2	1.3	2.7
Computer Technology	1	0.6	1.4
Statistics	1	0.6	1.4
English	1	0.6	1.4

*Note 1: Of the 156 beginning data processing personnel in this study 73 responded to this part of the questionnaire and 83 did not express any opinion.

Note 2: This table should read as follows: Of the 156 beginning data processing personnel in this study, 55 or 35.2 percent (N%) wished they had taken a course in data processing. Those 55 represented 75.4 percent (n%) of the 73 who responded to this part of the questionnaire.

TABLE XXIII

POST SECONDARY EDUCATION, OTHER THAN UNIVERSITY,
BY THE BEGINNING DATA PROCESSING PERSONNEL

Classification	Total	Percent of Total (N%)	Percent Within Classification (n%)
Years of Training			
Less than one-half year	46	29.5	68.6
One year	17	10.9	25.4
Two years	2	1.3	3.0
Three years	2	1.3	3.0
TOTAL	67	43.0	100.0
Type of Training			
Data Processing and Computer Programming	21	13.5	31.3
Business Management and Accounting	20	12.8	29.8
Secretarial	18	11.5	26.9
Technologies (Gas, Electronics, etc.)	3	1.9	4.5
Services	1	0.6	1.5
Other	4	2.7	6.0
TOTAL	67	43.0	100.0

training was reported by 17; two years and three years of training each were listed twice. It is evident that even though a substantial number of the employees had training in post secondary institutions the length of training in most cases was of a short duration.

Table XXIII also shows the type of training the employees had in the post secondary institutions. The training was fairly evenly distributed over data processing, business management and accounting, and secretarial programs. Almost one-third of this group had training in data processing, which ranked first with 21 employees, followed by business management and accounting, 20; secretarial, 18; technologies, 3; services, 1; and "other," 4.

University Education

It is shown in Table XXIV that 14 employees had a university degree. This is 8.9 percent of all the respondents. One-half of the university graduates majored in science. Arts and commerce as university majors were reported three times each. One employee reported education as his major in university.

TABLE XXIV

DEGREE COMPLETED AND THE UNIVERSITY MAJOR OF THE BEGINNING DATA PROCESSING PERSONNEL

Degree Major	Total	N%	n%
Sciences	7	4.5	50.0
Arts	3	1.9	21.4
Commerce	3	1.9	21.4
Education	1	0.6	7.2
TOTAL	14	8.9	100.0

IV. EDUCATION AND TRAINING IN DATA PROCESSING

Since the study especially deals with the beginning data processing employees, a special section in the questionnaire was assigned to the length of training received in data processing in various educational institutions. The respondents were asked to indicate the number of full courses and short courses completed at educational institutions.

Data Processing Training in Educational Institutions

The total figures in Table XXV show that one-third of the employees reported having taken full courses. Of the 52 who had taken full courses in data processing, over one-half had taken only one course; however, 20 employees reported having completed two full courses; 4 reported three courses; none reported four courses; and 3 reported five courses completed.

High school and university courses predominated in the data processing education reported by the respondents. Training in each institution was reported by 19 employees. The other institutions in which the employees had taken data processing training were: post secondary institutions, 8; extension and evening credit programs, 2; and "other," 4.

The majority of the group which had taken university training in data processing had taken only one course. Only three had taken two courses in data processing at a university. On the other hand, of the group which had taken courses in data processing in a high school, 14 had taken two courses, and five reported taking only one course. Of the eight respondents who had taken courses at post secondary institutions,

TABLE XXV

AMOUNT OF TRAINING IN DATA PROCESSING BY THE BEGINNING DATA PROCESSING PERSONNEL IN VARIOUS EDUCATIONAL INSTITUTIONS

Institution	Number of Full Courses						Number of Short Courses					
	Total	1	2	3	4	5	Total	1	2	3	4	5
High School	19	5	14	0	0	0	2	1	1	0	0	0
Post Secondary Institute	8	5	1	1	0	1	16	10	5	0	0	1
University	19	16	3	0	0	0	4	3	0	1	0	0
Extension and Evening Credits	2	1	0	1	0	0	9	4	4	1	0	0
Other	4	0	2	2	0	0	8	7	1	0	0	0
TOTAL	52	27	20	4	0	1	39	25	11	2	0	1

five of them had taken only one course. It appears that with the exception of the high school group, most of the respondents had taken only one course in data processing in an educational institution.

Data were also collected regarding the courses which were designed to provide an introduction to data processing. These were short courses or units on data processing taught in another course.

Table XXV shows that of the 39 who had taken these short courses, 25 of them had taken only one course, 11 had taken two; 2 had taken three courses; and one had taken five. The majority of the group which had taken the short courses had taken them in post secondary institutions. The number reporting this source of training was 16. Nine persons reported having taken extension and evening credit courses; 4 reported university courses; 2, high school courses; and 8, other sources of training. It is evident from the figures in Table XXV that only a small portion of the beginning data processing personnel had extensive formal training in data processing. The majority of them had taken only one course.

Data Processing Training Ouside the Educational Institutions

The preceding section of the study dealt with the classroom type of education in data processing. The following section deals with the sources of training other than the educational institutions. The sources of training identified were:

1. On-the-job training.
2. Programs sponsored by the computer manufacturers.
3. Company sponsored programs.

It is shown in Table XXVI that on-the-job training was the major source of training in data processing outside the educational institutions. Ninety-four responded that they had on-the-job training. Of this group, 58 employees stated that they had most of their training on the job and 36 had some of it at this source. Programs sponsored by computer manufacturers were listed by 47. Twenty respondents reported "most," and 27 "some" of their training from this source.

Since very few companies have their own educational programs, only 36 employees had training from this source. Eleven of them stated that they had most of their training from such programs, and 25 reported having some training from this source.

TABLE XXVI

SOURCES, OTHER THAN EDUCATIONAL INSTITUTIONS, OF TRAINING IN DATA PROCESSING RECEIVED BY BEGINNING DATA PROCESSING PERSONNEL

Source	Total	N%	Most			Some		
			No.	N%	n%	No.	N%	n%
On-the-job Training	94	60.3	58	37.2	61.7	36	23.1	38.3
Programs Sponsored by Computer Manufacturers	47	30.1	20	12.8	42.6	27	17.3	57.4
Company Sponsored Programs	36	23.1	11	7.1	30.6	25	16.0	69.4

It is apparent that the workers in data processing need training before they can produce work of an acceptable standard and quantity. Most of them receive training on the job. The training on the job tends to be of a limited scope. The workers may only be taught the basic procedures rather than the broader concepts. The on-the-job training

may be designed to produce immediate results rather than the insight into the job which would result from more formal training.

V. COMMENTS, REMARKS AND SUGGESTIONS

Beginning Data Processing Personnel

Space was provided on the questionnaire for the respondents to give suggestions and comments pertaining to the data processing program in high schools. The subjects were asked to express their opinions about the present data processing programs and to suggest changes which they would like to see effected in data processing courses. This part of the questionnaire was of open-response type.

Responses were given by 61 beginning employees. The length of the remarks varied from one sentence to a full page. The remarks also varied from that given by the respondents stating that they were unable to express any opinion to the very concrete suggestions of other respondents. Some respondents had numerous suggestions and remarks. Table XXVII shows that about one-half of the respondents, 31 out of 61, suggested that data processing should be taught in high school. This group made this suggestion directly. The group also suggested that a data processing program in high school would be helpful to the students seeking employment and also would help them appreciate the importance of automation in business.

Although respondents had certain reservations about the teaching of data processing in high school, it was not suggested by any respondent that a course in data processing should not be taught at this level. The most common objections were to the cost of equipment involved and

the ability of the teachers available to teach a course in data processing.

It was suggested by 17 employees that a data processing program in high school should be of a practical rather than theoretical nature; the student should learn the application of the principles involved. It was suggested by most of the respondents in this group that "hands-on" experience should be stressed. On the other hand, 15 respondents remarked that a data processing program in high school should emphasize understanding of the basic principles involved. However, in most cases this latter group recommended that an introductory course should be offered to business education students as a part of the business education program.

Eleven respondents expressed the opinion that they were unable to give any comments pertaining to data processing programs in high school. In almost all cases, these respondents stated that there was no data processing program in their high school. Consequently, only 50 respondents gave positive suggestions and remarks.

Six employees commented that the present high school data processing program is not effective. The majority of this group mentioned that too much stress is placed on theory in high school. It was suggested that more practical training should be included in the data processing courses. Some respondents commented that they realized that most schools cannot afford to offer practical training as all the schools cannot afford the costly equipment necessary. Four employees suggested that schools cannot afford the costly equipment, and therefore cannot offer a full program in data processing. It was felt by some respondents that

most teachers of data processing are not fully qualified to teach the subject. It was suggested by four respondents that in order to teach a data processing program effectively, better trained teachers are required. It was also suggested by some respondents that the teacher of data processing should have practical experience himself.

The following responses were each noted twice: too much theory is taught; offer programs realistic to the jobs; girls are not hired as programmers, computer operators, and analysts; teach three years of data processing in high school; and emphasize training on a computer rather than on unit record equipment. The following suggestions were each noted once:

Offer keypunch training in high school.

More data processing training in high schools in rural districts.

Most business courses need improvement.

Unsatisfied with the business courses in high school.

Conduct tours of data processing installations and make use of reference material from the manufacturers of equipment.

Stress basic education rather than vocational education in high school.

Stress English, mathematics, geometry, and computing science in high school.

Stress both speed and accuracy in a business machines course in high school.

Schools need more data processing equipment in order to teach a course in data processing effectively.

TABLE XXVII

REMARKS AND SUGGESTIONS, OF THE BEGINNING DATA PROCESSING PERSONNEL, PERTAINING TO THE DATA PROCESSING PROGRAMS IN HIGH SCHOOL

Remarks and Suggestions	Number
Teach data processing in high school	31
More practical training in high school data processing programs	17
Teach data processing for basic understanding	15
Unable to give any comment about high school programs	11
High School data processing programs are not effective	6
High Schools cannot afford costly equipment	4
Better trained teachers in data processing	4
Too much theory is taught in data processing courses	2
Offer programs realistic to jobs in data processing	2
Give aptitude test to the prospective data processing students	2
Girls are not hired as computer operators, programmers and analysts	2
Teach three years of data processing in high school	2
Emphasize computer rather than unit record system	2
Offer keypunch training in high school	1
Offer more data processing programs in rural area	1
Most business courses need improvement	1
Unsatisfied with business education courses in high school	1
Conduct tours and use reference material from manufacturers of data processing equipment	1
Stress basic education rather than vocational education	1
Stress English, mathematics, geometry, and computing science	1
Emphasize both speed and accuracy in business machines courses	1
Schools need more data processing equipment	1

Supervisory Personnel

On Part A of the questionnaire, space was provided for remarks and comments of the supervisory personnel. The supervisory personnel were asked to provide suggestions and remarks pertaining to business education in general and data processing programs in particular.

Of the 25 data processing installations which participated in this study, six made written remarks in this section. The remarks varied both in length and content. One respondent wrote only a single sentence while, on the other hand, one respondent gave a full page of concrete suggestions for improvement of data processing programs in high school.

Since only a small number of respondents were involved, no tabulated analysis was made of the data. One firm reported that it had a small data processing department so they expected most of their employees to work independently almost immediately upon being employed.

Three respondents reported that, in their opinion, the present high school data processing program is not effective. In all cases it was suggested that more "hands-on" training be given to the students. One respondent reported that there is a gap between the high school education and on-the-job application. He felt that this gap will continue, but that efforts should be made to narrow it by constantly up-dating the business education programs to meet the demands of the business world.

The same respondent also suggested that data processing should be taught in high school. He noted, however, that inability to acquire costly equipment may hinder the offering of such a program. He found that the students who had taken the present data processing program in

high school were not properly trained to meet the needs of the business world.

It was suggested by one respondent that the school should utilize the facilities of the data processing departments of local business firms. Such a program could provide several hours of realistic experience to the students.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The concluding chapter of the study is designed to provide a summary of the findings and to present major conclusions of the report. In addition, the implications that the study may have for business education and further research are outlined. In order to relate the conclusions and findings of the study as a whole, a restatement of the objectives of the study and the methods followed are given first. This is provided so that the relationship between the objectives and the conclusions of the study is available for easier comparison. After the statement of the purposes of the study, a summary of the general conclusions of the study is presented. These are followed by two sections which deal with the recommendations of the study: recommendations first for business education, and second, recommendations for further research.

The goals of the present chapter, then, are to provide (1) a restatement of the objectives and the methods followed; (2) a statement of a summary and conclusion of the report; and (3) a statement of recommendations for business education curricula and indications of areas in need of further research.

I. THE PURPOSE AND THE METHOD OF THE STUDY

The study was divided into two parts in order to deal with the beginning data processing personnel in the Edmonton area. Part A of the questionnaire was to determine the major employers of the beginning data

processing personnel, the equipment used, and further employment opportunities in the field of data processing.

The second part of the study was to identify the beginning data processing personnel, the nature of the jobs performed by them, their experience, education, and methods of training, and the courses which have been most helpful to them in performing the present job. It was hoped that information obtained in the study would be of value in designing a data processing curriculum in Alberta.

The questionnaires were administered to 25 data processing installations and 156 beginning data processing personnel. The employees with not more than two years of experience in data processing were classified as beginning data processing personnel.

II. SUMMARY AND CONCLUSIONS

The findings of the study are set forth in detail in Chapter IV. The present section of the study deals with a summary of these findings and conclusions concerning beginning data processing personnel in the Edmonton area.

Summary of the Results of the Study

The majority of the data processing installations which participated in this survey were in government and public services.

A major portion of the firms were classified as large; about one-third were medium; and one-quarter were small. Most of the large firms were in government and public services, and transportation and construction classifications.

Two-thirds of the offices were large and about one-quarter were classified as small. Almost all the offices in government and public services were large. All offices in transportation and construction were large.

About one-half of the data processing installations were classified as small, and over one-third were large. One-half of the government and public services installations were large.

There was no relationship between the size of the offices and the size of the data processing installations in this study.

The largest number of data processing employees were working as keypunch and verifier operators. The next largest group was computer programmers. A substantial number of employees were working as supervisors of data processing, computer operators, tabulation machine operators, consol operators, and analysts.

Most of the employees were working full time on one job. Employees in small installations were expected to perform more than one activity during the course of their duty.

The largest number of additional employees required were in the categories of keypunch and verifier operators. However, a greater percentage increase was expected for programmers and consol operators than for keypunch and verifier operators. An increase of 33 percent was expected in both programmers and consol operators.

It was expected that over twice as many coding clerks will be required next year as are presently employed in this classification. A substantial number of additional computer operators were expected to be required for the next year.

Additional employees expected to be required were reported mostly by the large data processing installations.

Almost all of the firms noted that the present job classifications will exist from one to three years from now.

The most commonly used equipment was the keypunch and it was used by more firms than any other equipment. A considerable number of verifiers, tape units, sorters, computers, and disc units were used. Of the 25 installations, 22 were using computers.

A major portion of the beginning personnel were employed in government and public services firms. Wholesaling firms employed about one-quarter of the beginning workers. The least number of beginning workers were employed in services.

Most of the beginning data processing personnel were found in large data processing installations. Small firms, generally, did not appear to hire inexperienced workers.

The majority of the data processing personnel were young. Most of them were between the ages of 21 and 30. A substantial number reported their ages as under 20 years.

A majority of female workers is noticable but not overwhelming.

About one-half of the beginning employees were keypunch and verifier operators. A considerable proportion of the beginning workers were engaged as computer programmers, computer operators, and tabulation machine operators.

The positions for which training on the job could be easily obtained were mostly held by the beginning data processing workers. The classifications in which the beginning workers comprised a considerable

proportion of the total employees were: keypunch and verifier operators, computer programmers, data control clerks, computer operators, tabulation machine operators, and analysts.

About 40 percent of the employees were working for the present firm before starting in the present position. About one-fifth of the employees "walked in" and inquired about the positions available in the data processing department. Referral by another person also played an important role in securing the present position. School did not play a significant part in helping the students secure employment in data processing installations.

Most companies gave an opportunity to their own employees who could qualify to fill openings in data processing departments.

Most of the employees work full time on the activity which corresponds with their job titles.

A major portion of the beginning workers were in educational institutions immediately before starting at their present job. About one-quarter were engaged in other office jobs and a little over one-quarter in non-office jobs.

About 40 percent of the employees had no office experience before starting at the present position. About one-half of the beginning workers had less than five years of office experience.

About 45 percent of the beginning data processing workers did not have any non-office experience. About one-fifth of them reported less than one year of non-office experience. The non-office experience ranges from one to two years and three to five years were reported by a considerable number of employees.

Over three-quarters of the respondents had finished their high school education.

A majority of respondents followed senior matriculation, business, or a combination of these two programs, in high school.

Typewriting had been studied by more beginning workers than any other subject. About three-fourths of the beginning employees had taken this subject. A considerable number also reported taking bookkeeping, business mathematics, business machines, office practice, and record-keeping.

Data processing ranked eighth among the business subjects studied in high school.

The greatest number reported that they found typewriting the most helpful subject in their position. Data processing was ranked second among the most helpful subjects on the present job. The other subjects which were considered helpful on the present job by a considerable number of respondents were: mathematics, bookkeeping, and business machines.

A vast majority wished that they had taken data processing in order to prepare them better for the present job. Some employees wished that they had taken bookkeeping, typewriting, business machines, and business management in order to prepare them better for the present position. However, no one of these subjects appeared to be more important than the others.

Over 40 percent of the beginning workers had post-secondary education. The majority of this group had less than one-half year of such education. The post-secondary education was fairly evenly distributed over data processing, business management, accounting, and secretarial programs.

Less than 10 percent of the beginning workers had a university degree. One-half of this group had majored in science at a university.

About one-third of the respondents had training in data processing in various educational institutions. One-half of this group had only one full course and a very few had more than two such courses in data processing. High school and university were the major sources of data processing training among the educational institutions.

The short courses which are designed to provide instruction in data processing were taken by 25 percent of the respondents. However, most of the subjects reported taking only one such course.

Most of the employees reported that their major source of training in data processing was outside the educational institutions. Training on the job was considered the major source of training outside the educational institutions. Manufacturers' sponsored programs were considered an important source of training by a substantial number of employees. Company sponsored programs were listed by a few employees as a source of their training in data processing.

Most of the beginning employees recommended that high schools should teach data processing and that such a program should stress practical aspects of data processing training.

Conclusions

Some specific conclusions may be drawn from each of the findings reported in the previous section of the study, whereas other conclusions are only implied.

1. The greatest opportunities for young people who wish to obtain data processing jobs appear to be in the larger data processing

installations in government and public services, and wholesaling firms.

2. It appears that there will continue to be a demand for workers in data processing, particularly for the positions of keypunch and verifier operator, computer programmer, data control clerk, computer operator, tabulation machine operator and analyst.

3. Certain business education courses are particularly helpful to beginning data processing workers in performing the work demanded by their job.

4. There seems to be a considerable correlation between what the beginning data processing worker does on the job and what the job title he holds implies that he does on the job.

5. Employees in small data processing installations may be required to perform a wide variety of tasks.

6. It would be advantageous for high school students who are considering a career in the field of data processing to take data processing training in high school or post-secondary institutions.

7. Data processing employees generally need data processing training before they can produce work of acceptable standards.

8. Among the educational institutions, high schools are one of the major sources of training in data processing.

9. Training on the job seems to play the most important role for beginning data processing personnel. Manufacturers' and company-sponsored programs are an important adjunct to the education and training of the beginning data processing employees.

10. Schools are not playing an effective role in preparing persons for jobs in data processing.

11. Students may be able to secure positions in data processing installations after graduation from high school without further training and education.

12. Previous office experience does not seem to play a significant part in securing employment in data processing.

13. Even though the beginning data processing personnel feel that they need formal education in data processing, very few of them have such training.

14. If the beginning data processing employees were given another chance to take their education, they would take data processing, bookkeeping, typewriting, business machines and business management.

III. RECOMMENDATIONS

Recommendations for Business Education

To a large extent, business education is a vocational discipline. The study of data processing by students in high school is undertaken to prepare them to find employment in data processing installations.

In order to keep pace with the changes in business and industry, the curricula of vocational subjects should be dynamic and ever changing. The students should be prepared not merely in manipulative skills but also in understandings of and attitudes toward the work they will be doing. The content of a vocational subject should be meaningful and related to the actual job situations. One of the obligations of business education courses in high school is to prepare the students for employment. However, this can only be done efficiently if it is first

determined what courses or subjects are of greatest benefit to the students involved.

Upon the basis of the foregoing educational principles and upon consideration of the conclusions of this study, certain recommendations may be made. In the interest of conciseness and since more detailed discussion in support of these recommendations can be found in other parts of the study, the implications are presented here in point form.

1. It is recommended that a one-semester introductory course in data processing be made available to all business education students in Alberta. Such a course should be offered in Grades Eleven or Twelve.

2. Two years of data processing should be offered to students who plan to find employment in data processing installations after graduation from high school.

3. A one-year course in keypunching should be offered separate from the regular data processing course. The objective of such a course should be to prepare students for vocational proficiency.

4. "Hands-on" experience with equipment and realistic problems should be a part of the two-year data processing program.

5. Cooperative work experience should be an integral part of a data processing program.

6. High school data processing programs should concentrate on basic skill areas rather than more advanced courses for programmers and analysts. Students should be trained in the use of a wide range of equipment.

Recommendations for Further Research

In an exploratory study such as this one, many more problems are generated than are solved. Some of the possible areas for further

research, and problems in need of investigation, are outlined below.

1. A survey of the opinion of the data processing supervisory personnel concerning the high school education of workers entering the data processing departments.

2. A follow-up study to investigate the value of a background of data processing courses to the beginning data processing workers. Such a study should be conducted to determine whether the present data processing courses are achieving the objectives set forth in programs.

3. An investigation of the value of the occupational business experience to the beginning data processing personnel.

4. An analysis of the jobs performed by the data processing workers in order to determine the time required to complete training in data processing.

5. An investigation should be conducted to determine the best possible media, the courses or subjects, for reaching all the secondary school students who have an interest in and desire to study data processing for informative purposes only.

6. A study should be conducted to determine the specific background or business and non-business courses most desirable for high school students prior to taking data processing training for vocational purposes.

7. Further research in the area of data processing, similar to the present study, should be carried out periodically to inform the business educator of the rapidly changing conditions in business and industry pertaining to data processing.

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APPENDIX A

EXHIBIT A: THE QUESTIONNAIRE, PART A

EXHIBIT B: THE QUESTIONNAIRE, PART B

EXHIBIT C: THE COVERING LETTER

A SURVEY OF BEGINNING DATA PROCESSING PERSONNEL

IN THE EDMONTON AREA

P A R T A

This part of the questionnaire is to be answered by a data processing supervisory person.

Instructions: Please answer the following in regard to your firm. Place your answer in the space provided.

A. FIRM (Please check one in each section)

a. Type: (The general nature of business)

1. _____	1.	Wholesaling
2. _____	2.	Retailing
3. _____	3.	Manufacturing
4. _____	4.	Finance and Real Estate
5. _____	5.	Services
6. _____	6.	Transportation and Storage
7. _____	7.	Government and Public Services
8. _____	8.	Public Utilities
9. _____	9.	Other (specify)_____

b. Size:

I. Total number of employees (including office and non-office employees)

1. _____	1.	1 - 100
2. _____	2.	101 - 500
3. _____	3.	501 and over

II. Total number of office employees

1. _____	1.	1 - 25
2. _____	2.	26 - 50
3. _____	3.	51 and over

III. Total number of data processing employees

1. _____	1.	1 - 15
2. _____	2.	16 - 30
3. _____	3.	31 and over

IV. Total number of employees with fewer than two years experience in data processing:

B. JOB CLASSIFICATION

Job Classification	No. of Positions				In your opinion will the job exist 1-3 yrs. from now?		Approx. number of (additional) employees you will require next year.
	Full time	Half time	Quarter time	Occasionally	YES	NO	
Consol Operator							
Supervisor, data processing							
Card-Tape-Converter Operator							
Assistant Consol Operator							
Tape handler							
Computer Operator							
High Speed Printer Operator							
Key-Punch Operator							
Data Typist							
Verifier Operator							
Tabulation Machine Operator							
Sorting Machine Operator							
Coding Clerk							
Computer Programmer							
Analyst							
Punch Card Machine Technician							
Others (specify)							

_____

_____

C. EQUIPMENT

Type of Equipment	No. of Units
Key Punch	
Sorter	
Verifier	
Collator	
Tabulator	
Tape Unit	
Disc Unit	
Computer	
MICR Machine	
Optical Scanner	

Others (specify) _____

D. RESPONDENT

Name: _____

Title: _____

Company Name and Address

_____

_____

_____

_____

Telephone No: _____ Extension: _____

Would you like to receive a summary of the report? 1. _____ 1. YES

2. _____ 2. NO

E. REMARKS:

Your opinions, suggestions and comments relating to high school business education programs in general and data processing in particular will be appreciated.

A SURVEY OF BEGINNING DATA PROCESSING PERSONNEL

IN THE EDMONTON AREA

P A R T B

This part of the questionnaire is to be answered by all employees who have fewer than two years experience in data processing.

Instructions: Please mark your answer in the space provided.

A. EMPLOYEE

a. Age in Years

1. _____	1.	Under 20
2. _____	2.	21 - 30
3. _____	3.	31 - 40
4. _____	4.	40 and over

b. Sex

1. _____	1.	Male
3. _____	2.	Female

c. Name:

d. Title:

e. Company Name and Address:

_____

_____

_____

f. Office Telephone No: _____ Extension: _____

g. Would you like to receive a summary of the report?

1. _____	1.	YES
2. _____	2.	NO

PART B

B. JOB (Please check appropriate column(s))

a.

Job Classification	Approximate time spent		
	HOURS		
	Daily	Weekly	Monthly
Consol Operator			
Supervisor, data processing			
Supervisor, machine tabulating unit			
Card-Tape-Converter Operator			
Assistant Consol Operator			
Tape handler			
Computer Operator			
High Speed Printer Operator			
Key-Punch Operator			
Data Typist			
Verifier Operator			
Tabulation Machine Operator			
Sorting-Machine Operator			
Coding Clerk			
Computer Programmer			
Analyst			
Punch Card Machine Technician			
Others (specify) _____ _____			

b. Method of Acquiring the Present Job (please check one)

1. _____ 1. Canada Manpower Centre
2. _____ 2. Newspaper
3. _____ 3. School
4. _____ 4. Referral by a friend or some other person
5. _____ 5. Promotion within the company
6. _____ 6. Transfer within the company
7. _____ 7. Walked in
8. _____ 8. Other (specify) _____

B. JOB (cont'd) 123

c. Occupation or activity before starting at the present job. (Check only one space in this section)

I. Educational Institution

1. _____ 1. High School
2. _____ 2. Technical School or Institution
3. _____ 3. University
4. _____ 4. Other (specify) _____

II. Other Office Job

1. _____ 1. With the present employer
2. _____ 2. With some other employer

III. Other non-Office Job

1. _____ 1. With the present employer
2. _____ 2. With some other employer

IV. Other (specify) _____

C. EXPERIENCE (Please check one answer in each section)

a. Data Processing

1. _____ 1. Less than six months
2. _____ 2. More than six months, but less than one year
3. _____ 3. One to one and a half years
4. _____ 4. Two years

b. Office Occupations (other than data processing)

0. _____ 0. None
1. _____ 1. Less than one year
2. _____ 2. One to two years
3. _____ 3. Three to five years
4. _____ 4. Six to ten years
5. _____ 5. Ten years or over

c. None-Office Occupations

0. _____ 0. None
1. _____ 1. Less than one year
2. _____ 2. One to two years
3. _____ 3. Three to five years
4. _____ 4. Six to ten years
5. _____ 5. Ten years or over

C. EXPERIENCE (cont'd)

d. List any non-office occupations in which you have had experience.

1. _____

2. _____

3. _____

4. _____

D. EDUCATION

a. High School (Check one)

1. _____ 1. Completed
2. _____ 2. Not completed

b. High School Program (Check one)

1. _____ 1. Business Education
2. _____ 2. Senior Matriculation (University Entrance)
3. _____ 3. General
4. _____ 4. Vocational
5. _____ 5. Combination of Business and Senior Matriculation
6. _____ 6. Other

c. Business Subjects Studied in High School (Please circle the highest level reached)

Subject	Grade Level Reached		
	X	XI	XII
Bookkeeping	10	20	30
Typing	10	20	30
Business Machines			30
Shorthand	10	20	30
Office Practice		20	30
Data Processing		22	32
Business Mathematics	11	22	
Business Management			30
Business Fundamentals	10		
Business Law		20	
Merchandising		20	
Record Keeping	10		
Clerical Office Practice		20	
Economics			30
Others (specify)			

_____

_____

D. EDUCATION (cont'd)

d. List the courses you consider have been most helpful in relation to your present job, in order of most important first.

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

e. List the courses which you wish you ~~have~~ had taken to prepare you better for your present job.

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

f. Post secondary education

(Northern or Southern Alberta Institute of Technology, Junior Colleges, and other post secondary institutes outside Alberta.)

Training in number of years:

1. _____ 1. None
2. _____ 2. Short course less than six months in duration
3. _____ 3. One year
4. _____ 4. Two years
5. _____ 5. Three years

Type of training (Nature of the subjects studied at post secondary institutions)

1. _____ 1. Business Management and Accounting
2. _____ 2. Secretarial
3. _____ 3. Data Processing and Computer Programming
4. _____ 4. Technologies (Gas, Electronics, etc)
5. _____ 5. Services (Food Preparation, Beauty Culture, etc)
6. _____ 6. Other (specify) _____

g. University

Degree completed:
1. _____ 1. Yes
2. _____ 2. No

University Degree in:
1. _____ 1. Arts
2. _____ 2. Sciences
3. _____ 3. Commerce
4. _____ 4. Education
5. _____ 5. Computer Science
6. _____ 6. Other: (specify) _____

PART B

E. TRAINING FOR DATA PROCESSING

a. Answer this section if you had any formal training in data processing or computer science in one of the following institutions.

In column (a) circle the number of full courses completed
In column (b) circle the number of short courses completed

INSTITUTION	FULL COURSES COMPLETED (a)	SHORT COURSES COMPLETED (b)
High School	0 1 2 3 4 5	0 1 2 3 4 5
Post Secondary Institutions	0 1 2 3 4 5	0 1 2 3 4 5
University	0 1 2 3 4 5	0 1 2 3 4 5
Extension or Evening Credit	0 1 2 3 4 5	0 1 2 3 4 5
Correspondence	0 1 2 3 4 5	0 1 2 3 4 5
Others (specify)		
_____	0 1 2 3 4 5	0 1 2 3 4 5
_____	0 1 2 3 4 5	0 1 2 3 4 5

b. Other means of training other than the educational institutions listed above.

SOURCE OF TRAINING	MOST	SOME	NONE
Manufacturers' Sponsored Programs (IBM, N.C.R., Honeywell, etc)			
Company Sponsored Programs			
On the Job Training			
Others (specify) _____ _____			

PART B

F. REMARKS

Please give your suggestions, opinions, and comments relating to data processing programs in the high schools.

Queen Elizabeth Composite High School
9425 - 132 Avenue
Edmonton, Alberta.

One of the biggest problems facing the educator of today is to continuously improve his program of studies to meet the changing needs of business and industry. Business leaders of Edmonton have always given tremendous support and co-operation to high school teachers, and I hope that I can count on your support for my present project. The project is a thesis pertaining to my M.S. degree in Business Administration at the University of Montana, Missoula.

The project is "A Survey of Beginning Data Processing Personnel in the Edmonton Area" with a view to determine the changes expected in the field of data processing and the changes to be incorporated in the high school data processing curriculum. It is an attempt to provide better qualified workers for the modern business offices in Edmonton. I would appreciate it if you would complete the two-part questionnaire enclosed with this letter.

Part A, the coloured sheets, is to be completed by you or some other data processing supervisory person. Part B is to be completed by all those employees who have two years or less experience in data processing. I am enclosing copies of part B. If you need more copies please call me at 479-2091 or 469-7128.

The information supplied by you will be revealed only in a cumulative form, no respondent(s) will be identified individually with any particular data. I am enclosing a self-addressed and stamped envelope for your convenience in returning the completed questionnaires.

Your early attention to this matter will be greatly appreciated.

Sincerely yours,

KULDIP S. RIAR.

KSR:dmb

APPENDIX B

NAMES OF THE FIRMS WHICH PARTICIPATED IN THE STUDY

NAMES OF THE FIRMS WHICH PARTICIPATED IN THE STUDY

Alberta Government Telephones
Alberta Government Treasury Branch
Alberta Liquor Control Board
Alberta Motor Association
Angus R. Alberta Ltd.
Banister Construction (1963) Ltd.
Canadian National Railways

City of Edmonton
Dresser Industries Canada Ltd.
Great Western Garment Co. Ltd.
Imperial Oil Ltd.
Inland Cement Industries Ltd.
International Business Machines Co. Ltd.
Medical Services (Alberta) Inc.

Merco Wholesale Ltd.
Northwestern Utilities Ltd.
Rapid Data Ltd.
Unemployment Insurance Commission
University of Alberta
Werner's Refrigeration Co. Ltd.
Western Supplies Ltd.
White Stag of Canada